USER'S GUIDE

T-BERD 224
PCM ANALYZER

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T-BERD 224
PCM ANALYZER
USER'S GUIDE

JUNE 1993

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INTRODUCTION
T-BERD 224 USER'S GUIDE

The *T-BERD 224 User's Guide* offers an easy, direct method to operate the T-BERD 224. It presents the most commonly used test setups in complete and concise steps. Aids such as illustrations, helpful notes, and step-by-step procedures make this user's guide a unique testing aid for new and experienced users.

This user's guide is designed for the user who needs to know the basics for testing. It does not describe everything about the T-BERD 224; your *T-BERD 224 Reference Manual* fully addresses the operation of the instrument.

The following features will enable you to use the T-BERD 224 to your best advantage.

TEST SETUPS - This section provides instrument setups and connection procedures to connect the T-BERD 224 to a T1 circuit. A Test Setup is referenced in the first step of each application.

Monitor Test Setup
Termination Test Setup - Internal Timing
Termination Test Setup - Recovered Timing
DCS Test Access Di-group (TAD) Test Setup
Drop and Insert Test Setup

APPLICATIONS - This section provides information on operating the T-BERD 224 in a variety of common test scenarios. The T-BERD 224 Options required to perform the test are identified with each test scenario. The test scenarios and instrument setups are grouped into the following applications:

T1 Testing
Fractional T1 Testing
SLC Network Testing
ESF Network Testing
DDS Network Testing
VF Testing
Signaling Testing
Level 2 Protocol Testing

RESULTS AND ALARMS - Refer to this section when you are unfamiliar with the meaning of a result or an alarm.

TEST SETUPS

This section provides instrument setups and connection procedures to connect the T-BERD 224 to a T1 circuit. The first step of each application, *T1 circuit connections*, references a *Test Setup*. Perform the steps in the referenced *Test Setup* first, then proceed with the application. The referenced *Test Setup* is dependent on how the T-BERD 224 is connected to the T1 circuit. If more than one *Test Setup* is referenced, use the one appropriate for your testing. Five basic *T1 circuit connections* are provided.

Monitor Test Setup

Termination Test Setup - Internal Timing

Termination Test Setup - Recovered Timing

DCS Test Access Di-group (TAD) Test Setup

Drop and Insert Test Setup

1. Monitor Test Setup

Use this test setup to configure the T-BERD 224 to monitor a T1 circuit or specific channels from a DSX-1 patch panel. This procedure is not application specific. It is referenced in the *Applications Section* when the T-BERD 224 is configured to monitor a T1 circuit.

Figure 1 illustrates a T-BERD 224 connected to a DSX-1 patch panel to monitor a full duplex T1 circuit.

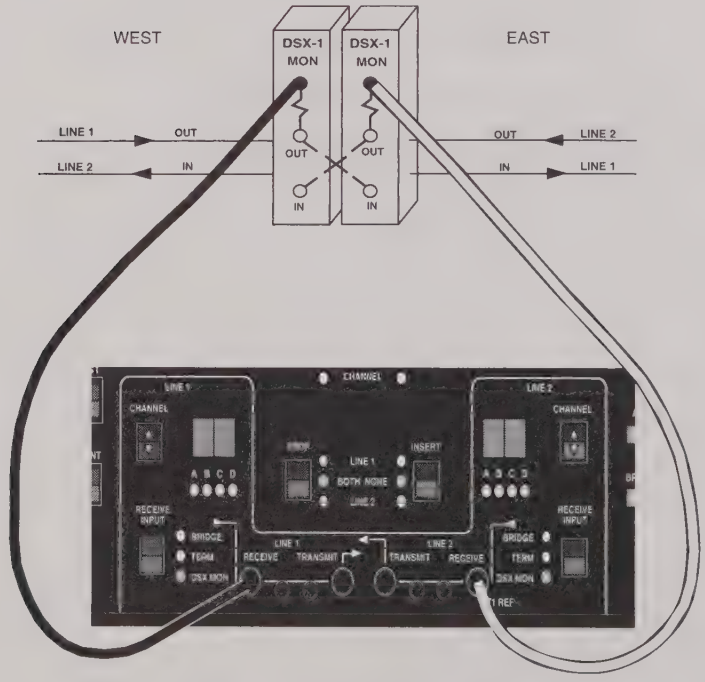


Figure 1
Monitoring a T1 Circuit

1. **MODE switch**
   Set according to specific application.

2. **CHANNEL FORMAT switch**
   Set according to specific application (Full T1, VF, DDS, etc.).

3. **SCI and SCII switches**
   Set according to specific application.

4. **CODE switch**
   Set to B8ZS or AMI.

5. **DROP switch**
   Set to BOTH.

6. **INSERT switch**
   Set to NONE.

7. **LINE 1 & 2 CHANNEL switch**
   Set to the T1 channel (1 to 24) to be tested.

8. **LINE 1 & 2 RECEIVE INPUT switch**
   Set to DSX MON.

   NOTE: If the DSX-MON jacks are not resistor isolated set the **RECEIVE INPUT** switch to BRIDGE.

9. **LINE 1 RECEIVE jack**
   Connect a cable from the LINE 1 RECEIVE jack to DSX-1 WEST MON jack.

10. **Local Status LEDs - LINE 1**
    Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

11. **LINE 2 RECEIVE jack**
    Connect a cable from the LINE 2 RECEIVE jack to DSX-1 EAST MON jack.

12. **Local Status LEDs - LINE 2**
    Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

13. **Proceed to a specific test in one of the *Application Sections*: T1, Fractional T1, SLC, ESF, DDS, VF, Signaling or Level 2 Protocol Testing.**

2. Termination Test Setup - Internal Timing

Use this test setup to configure the T-BERD 224 to terminate a circuit. This procedure is not application specific. It is referenced when the T-BERD 224 is configured to terminate a T1 circuit and supply timing to the network.

Figure 2 illustrates a T-BERD 224 terminating the T1 circuit's traffic in the east direction. To terminate the circuit in the WEST direction, substitute WEST for EAST in the applicable steps.

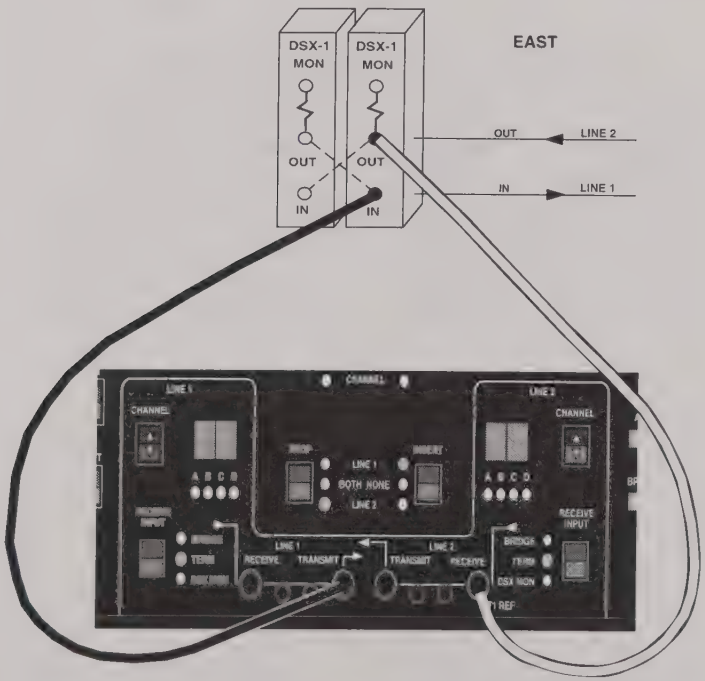
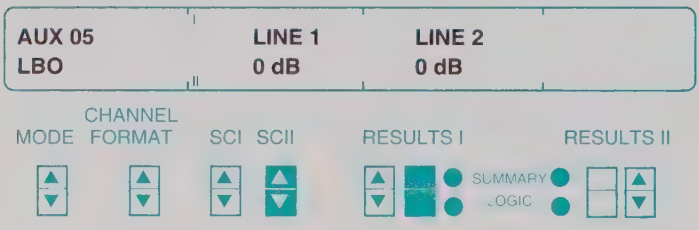


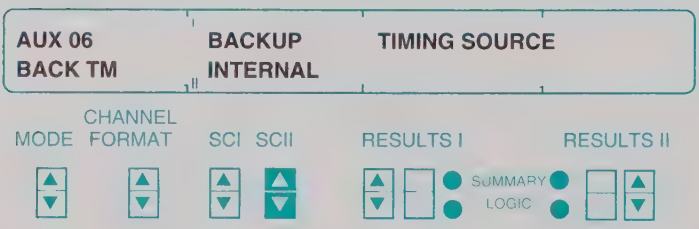
Figure 2
Terminating a T1 Circuit – Internal Timing

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 05 LBO. Configure as shown.



   Select AUX 06 BACK TM. Configure as shown.



2. **AUX switch**
   Press to exit the auxiliary functions (LED OFF).

3. **MODE switch**
   Set according to specific application.

4. **CHANNEL FORMAT switch**
   Set according to specific application.

5. **SCI and SCII switches**
   Set according to specific application.

6. **CODE switch**
   Set to B8ZS or AMI (sets transmitter only).

7. **DROP switch**
   Select LINE 2.

8. **INSERT switch**
   Select LINE 1.

9. **LINE 1 & 2 CHANNEL switches**
   Set to the T1 channel (1 to 24, ALL) to be tested.

10. **LINE 2 RECEIVE INPUT switch**
    Set to TERM.

11. **LINE 1 TRANSMIT jack**
    Connect a cable from the LINE 1 TRANSMIT jack to the DSX-1 IN jack.

12. **LINE 2 RECEIVE jack**
    Connect a cable from the LINE 2 RECEIVE jack to the DSX-1 OUT jack.

13. **Proceed to a specific test in the *Application Sections*: T1, Fractional T1, SLC, ESF, DDS, VF, Signaling or Level 2 Protocol Testing.**

3. Termination Test Setup - Recovered Timing

Use this test setup to configure the T-BERD 224 to terminate a circuit. This procedure is not application specific. It is referenced when the T-BERD 224 is configured to terminate the circuit and recover timing from the network.

Figure 3 illustrates a T-BERD 224 terminating the T1 circuit traffic in the EAST direction. To terminate the circuit in the WEST direction, substitute WEST for EAST in the applicable steps.

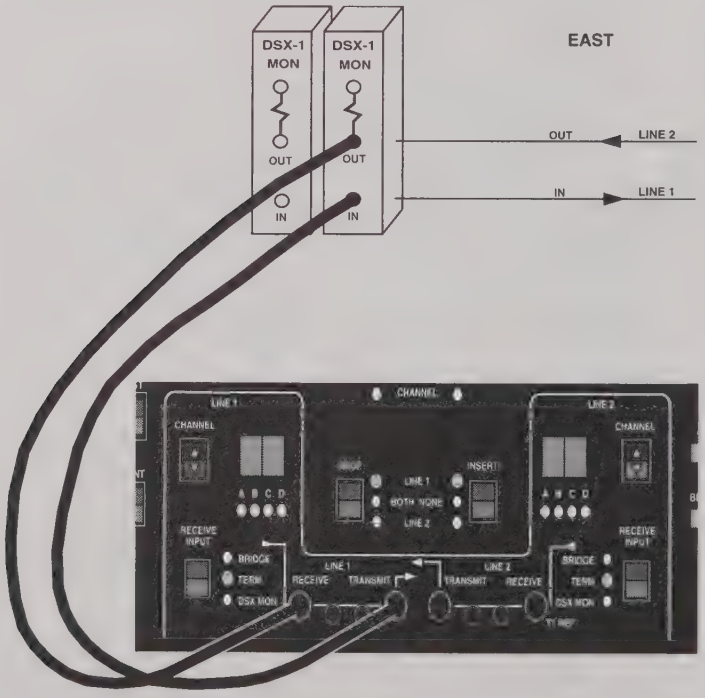
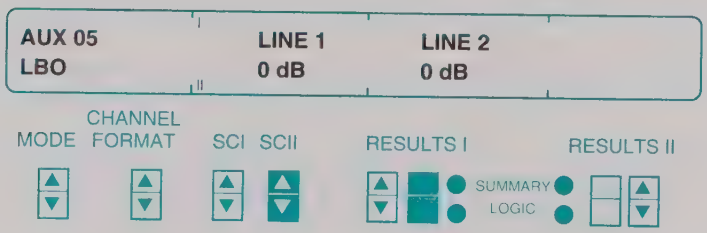


Figure 3
Terminating a T1 Circuit – Recovered Timing

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 05 LBO. Configure as shown.



2. **AUX switch**
   Press to exit the auxiliary functions (LED OFF).

3. **MODE switch**
   Set according to specific application.

4. **CHANNEL FORMAT switch**
   Set according to specific application.

5. **SCI and SCII switches**
   Set according to specific application.

6. **CODE switch**
   Set to B8ZS or AMI (sets transmitter only).

7. **DROP switch**
   Select LINE 1.

8. **INSERT switch**
   Select LINE 1.

9. **LINE 1 CHANNEL switch**
   Set to the T1 channel (1 to 24, ALL) to be tested.

10. **LINE 1 RECEIVE INPUT switch**
    Set to TERM.

11. **LINE 1 TRANSMIT jack**
    Connect a cable from the LINE 1 TRANSMIT jack to the DSX-1 IN jack.

12. **LINE 1 RECEIVE jack**
    Connect a cable from the LINE 1 RECEIVE jack to the DSX-1 OUT jack.

13. **Proceed to a specific test in the *Application Sections*: T1, Fractional T1, SLC, ESF, DDS, VF, Signaling or Level 2 Protocol Testing.**

4. DCS Test Access Di-group (TAD) Test Setup

Use this test setup to configure the T-BERD 224 to access the T1 circuit from the DCS TAD. This procedure is not application specific. It is referenced when the T-BERD 224 is configured to test the T1 circuit from the DCS TAD.

Figure 4 illustrates a T-BERD 224 connected to the T1 circuit from the DCS TAD.

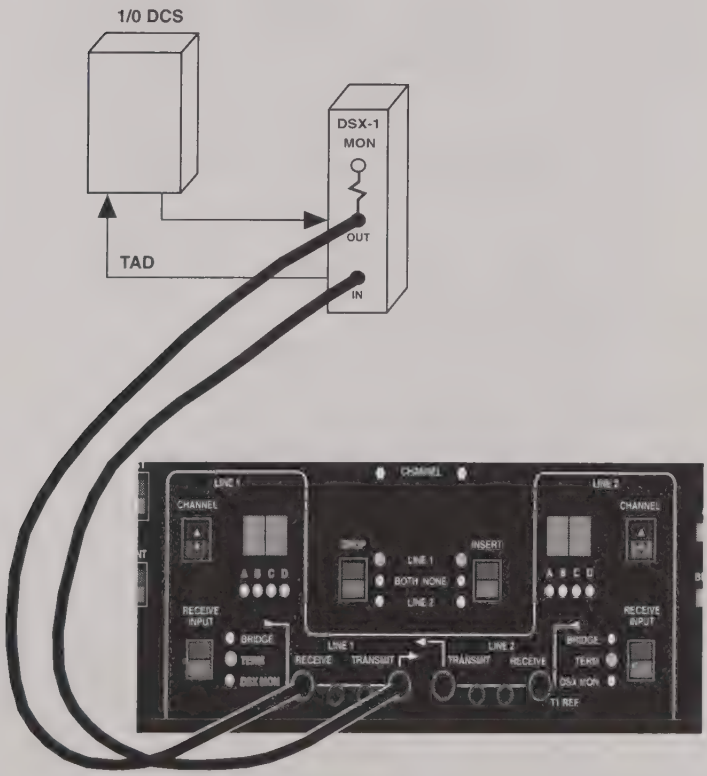
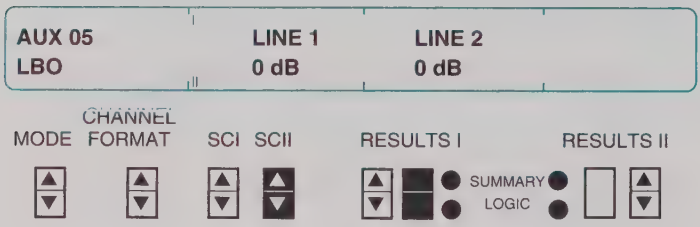


Figure 4
TAD Setup

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 05 LBO. Configure as shown.



2. **AUX switch**
   Press to exit the auxiliary functions (LED OFF).

3. **MODE switch**
   Set according to specific application.

4. **CHANNEL FORMAT switch**
   Set according to specific application.

5. **SCI and SCII switches**
   Set according to specific application.

6. **CODE switch**
   Set to B8ZS or AMI (sets transmitter only).

7. **DROP switch**
   Select LINE 1.

8. **INSERT switch**
   Select LINE 1.

9. **LINE 1 CHANNEL switch**
   Set to the T1 channel (1 to 24, ALL) to be tested.

10. **LINE 1 RECEIVE INPUT switch**
    Set to TERM.

11. **LINE 1 TRANSMIT jack**
    Connect a cable from the LINE 1 TRANSMIT jack to the DSX-1 IN jack on the DCS TAD.

12. **LINE 1 RECEIVE jack**
    Connect a cable from the LINE 1 RECEIVE jack to the DSX-1 OUT jack on the DCS TAD.

13. **Proceed to a specific test in the *Application Sections*: T1, Fractional T1, SLC, ESF, DDS, VF, Signaling or Level 2 Protocol Testing.**

5. Drop and Insert Test Setup

This test setup configures the T-BERD 224 to drop a channel from Line 1, Line 2, or both lines without disrupting the T1 signal. This procedure is not application specific. It is referenced when the T-BERD 224 is configured to drop and insert a signal on a particular channel.

Figure 5 illustrates a T-BERD 224 connected to a DSX-1 patch panel to perform drop and insert testing.

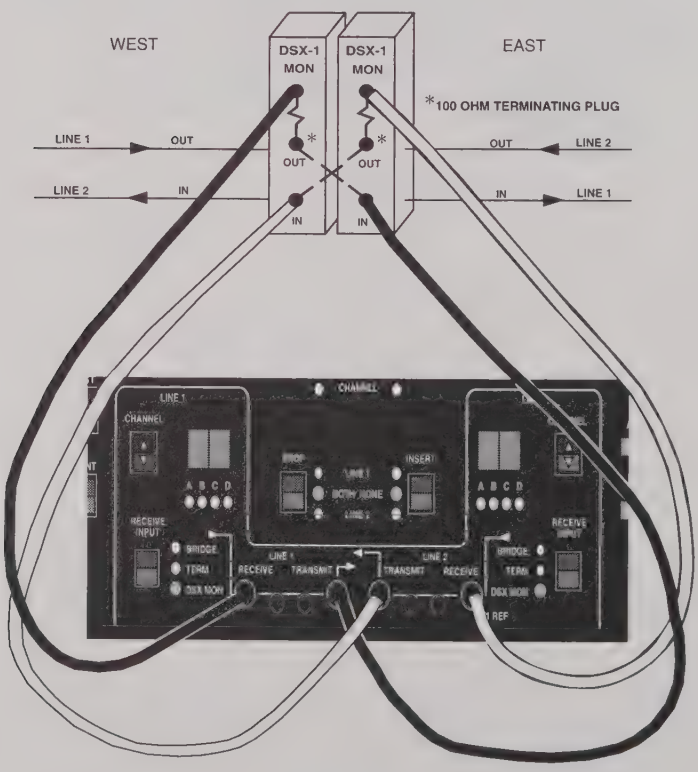
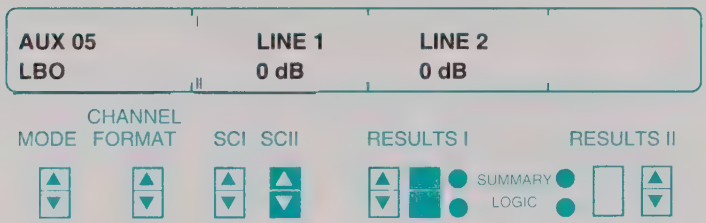


Figure 5
Drop and Insert Testing

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 05 LBO. Configure as shown.



2. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

3. **MODE switch**
   Set according to specific application.

4. **CHANNEL FORMAT switch**
   Set according to specific application.

5. **SCI and SCII switches**
   Set according to specific application.

6. **CODE switch**
   Set to B8ZS or AMI (sets transmitter only).

7. **DROP switch**
   Set to BOTH.

8. **INSERT switch**
   Set to NONE.

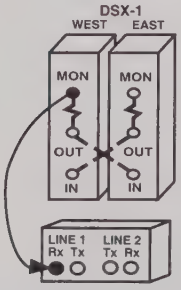
   NOTE: Initially the **DROP** switch is set to BOTH and the **INSERT** switch is set to NONE to minimize the interruption of the T1 circuit during the connection procedure. Once the T-BERD 224 is connected to the T1 circuit, individual channels can be tested.

9. **LINE 1 & 2 CHANNEL switch**
   Set to T1 channel (1 to 24) to be tested.

10. **LINE 1 & 2 RECEIVE INPUT switch**
    Set to DSX MON.

    NOTE: If the DSX-MON jacks are not resistor isolated set the **RECEIVE INPUT** switch to BRIDGE.

11. **LINE 1 RECEIVE jack**
    Connect a cable from the LINE 1 RECEIVE jack to DSX-1 WEST MON jack.

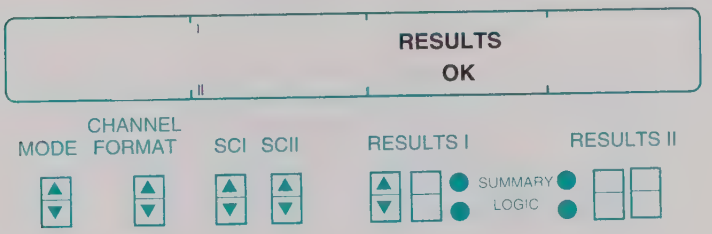


12. **RESTART switch**
    Press to clear all results.

13. **Local Status LEDs — LINE 1**
    Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

14. RESULTS I switches

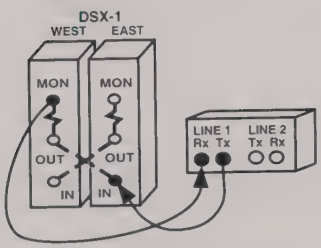
Select the SUMMARY Category. Verify results are *OK*.



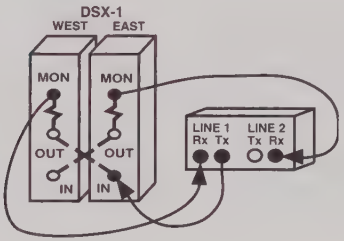
15. LINE 1 TRANSMIT jack

Connect a cable from the LINE 1 TRANSMIT jack to the DSX-1 EAST IN jack.

CAUTION: Connect the cable to the T-BERD 224, then to the DSX-1 EAST IN jack. If the cable is connected to the DSX-1 jack first, it will take down the T1 circuit.

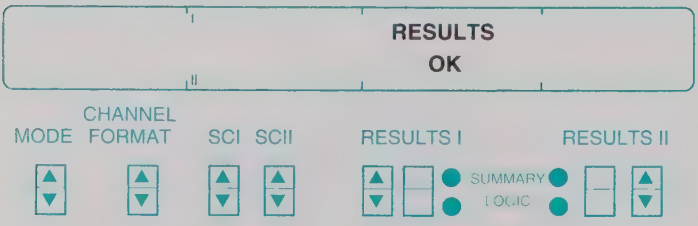


16. **LINE 2 RECEIVE jack**
    Connect a cable from the LINE 2 RECEIVE jack to DSX-1 EAST MON jack.



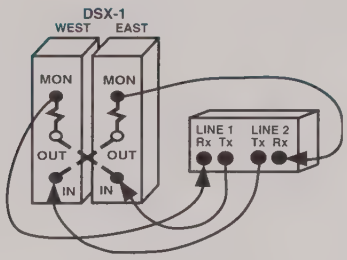
17. **Local Status LEDs — LINE 2**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

18. **RESULTS I switches**
    Select the SUMMARY Category. Verify results are *OK*.



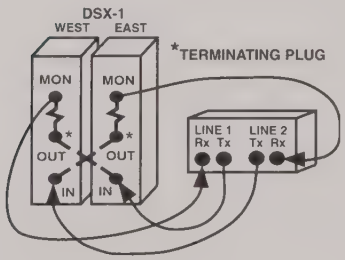
19. **LINE 2 TRANSMIT jack**
    Connect a cable from the LINE 2 TRANSMIT jack to the DSX-1 WEST IN jack.

    CAUTION: Connect one end of the cable into the T-BERD 224, then connect the other end into the DSX-1 WEST IN jack. If the cable is connected to the DSX-1 jack first, it will take down the T1 circuit.



20. **100 ohm terminating plugs**

Insert a 100 ohm terminating plug into the DSX-1 EAST and WEST OUT jacks.



21. **Proceed to a specific test in the *Application Section*: T1, Fractional T1, SLC, ESF, DDS, VF, Signaling or Level 2 Protocol Testing.**

NOTE: Disconnect the circuit in the reverse order.

APPLICATIONS

This section provides information on operating the T-BERD 224 in a variety of common test applications. The first step of each application, *T1 circuit connections*, references a *Test Setup*. The referenced *Test Setup* provides instructions on connecting the T-BERD 224 to the T1 circuit. Perform the steps in the referenced *Test Setup* first, then proceed with the application. If more than one *Test Setup* is referenced, use the one appropriate for your testing. The T-BERD 224 Options required to perform the test are identified with each application. The test scenarios and instrument setups are grouped into the following applications:

T1 Testing

Fractional T1 Testing

SLC Network Testing

ESF Network Testing

DDS Network Testing

VF Testing

Signaling Testing

Level 2 Protocol Testing

T1 TESTING

T1 Performance Monitoring

Timing Slips Analysis

Loopback Testing

Emulate Smart Jack/CSU at Customer Premise

MULTIPAT and BRIDGTAP Loopback Testing

6. T1 Performance Monitoring

- Non-intrusively monitor the T1 facility.
- Confirms that the T1 signal is properly received by the network equipment.

Figure 6 illustrates a T-BERD 224 monitoring the T1 signal from a DSX-1.

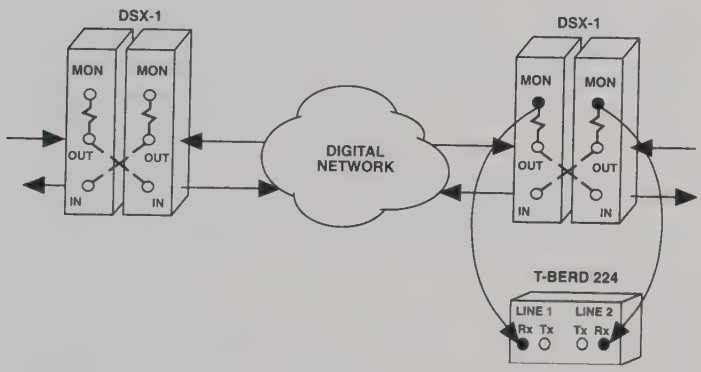


Figure 6
T1 Performance Monitoring

1. **T1 circuit connections — See *Monitor Test Setup***

2. **MODE switch**
   Set to AUTO.

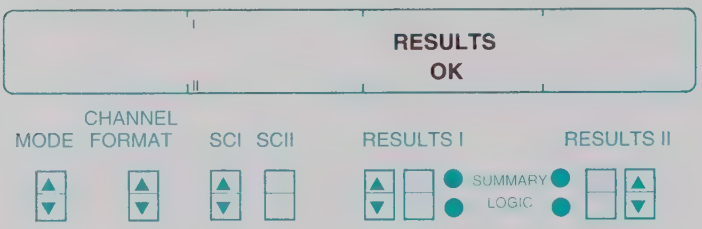
3. **DROP switch**
   Set to BOTH.

4. **INSERT switch**
   Set to NONE.

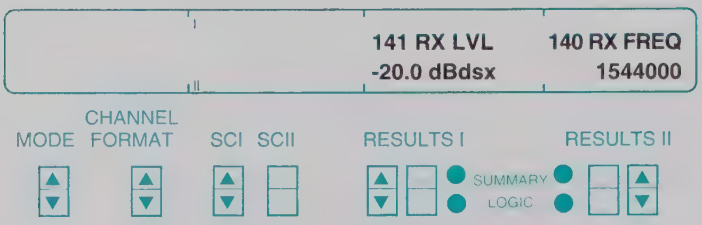
5. **RESTART switch**
   Press to begin the test and clear results.

6. **Local Status LEDs**
   Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

7. **RESULT I switches**
   Select SUMMARY Category. Verify results are *OK*.



8. **RESULTS II switches**
   Select the SIGNAL Category. Check the following results.



9. **Results interpretation**

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the transmission equipment timing or the network synchronization.

RX LVL

The received level should be -20 dB +/- 3 dB at resistor isolated DSX-MON jacks. Incorrect levels could be caused by a facility T1 line card or poor cabling between the DSX jack and the equipment.

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

FRM ERRORS, CRC ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further downstream.

Yellow Alarm LED

The far end will send a Yellow Alarm to indicate that it is not receiving a signal. Sectionalize the T1 equipment further.

AIS LED

This indicates that some equipment in the signal path towards your test set is not receiving a signal from the far end.

7. Timing Slips Analysis

- Confirms that all the network equipment is properly synchronized.
- Verify network timing.
- Isolate possible timing problems.

Figure 7 illustrates a T-BERD 224 testing for the presence of timing slips when the received T1 signal on LINE 1 is compared with a reference T1 clock source on LINE 2.

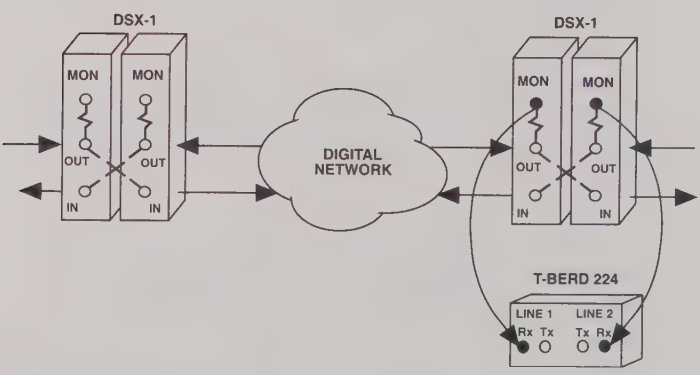


Figure 7
Timing Slips Analysis

1. **T1 circuit connections — See *Monitor Test Setup***

2. **MODE switch**
   Set to AUTO.

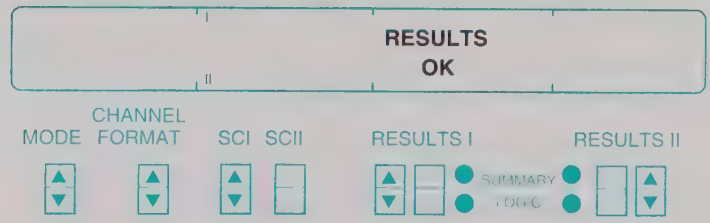
3. **RESTART switch**
   Press to begin the test.

4. **Local Status LEDs**

   Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

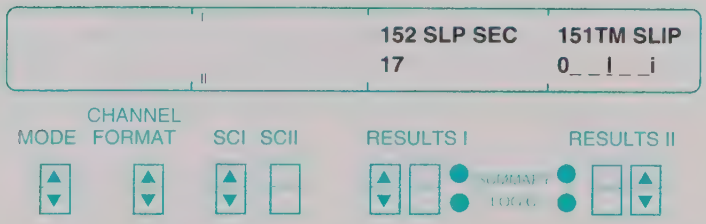
5. **RESULTS I switches**

   Select the SUMMARY Category. Verify results are *OK*.



6. **RESULTS switches**

   Select the SIGNAL Category. Check the following results.



The n51 TM SLP result is only available for LINE 1 when LINE 2 is acting as the T1 reference signal. However, if an external clock source is connected to the side panel BNC connector, both LINE 1 and LINE 2 results are available.

The n52 SLP SEC result will increment (accumulate) when both the T1 reference signal (LINE 2) and the received signal (LINE 1) are present. This result does not accumulate when either of these signals are lost.

7. **Results interpretation**

- If the T1 reference and receive signals are perfectly synchronized, the timing slip count remains at 0, the bar graph remains at center, and the wheel remains at top-center.

- If the T1 reference and received signals are synchronized, but one signal exhibits low-speed wander (e.g., Doppler shifts from satellites), the timing slip count remains at 0, the wheel moves clockwise, and the bar graph moves to the right as the satellite nears. As the satellite moves farther away, the timing slip count remains at 0, the wheel moves counter clockwise, and the bar graph moves to the left.

- If the T1 reference and received signals are unsynchronized, and the received signal frequency is higher than the T1 reference signal, the wheel moves clockwise, the bar graph moves to the right, and the timing slip increments every 193 bit slips. When the frequency difference is more than a few cycles (Hertz), the timing slip count, bar graph, and wheel move very rapidly.

- If the T1 reference and receive signals are unsynchronized, and the receive signal frequency is lower than the T1 reference signal, then the wheel moves counterclockwise, the bar graph moves to the left, and the timing slip count increments every 193 bit slips. When the frequency difference is more that a few Hertz, the timing slip count, bar graph, and wheel move very rapidly.

8. Loopback Testing
BERT Option Required

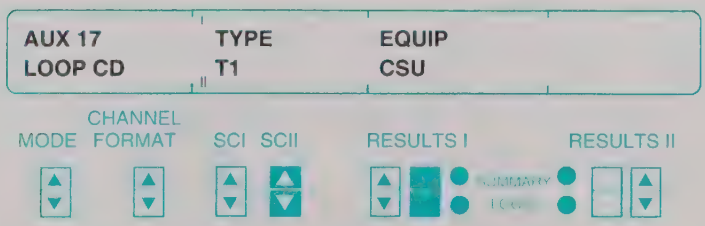
- Qualify T1 circuit's error performance.
- Check loopback response of transmission equipment.
- Select in-band or out-of-band smart jack or CSU loop codes.
- Send 1:7, 3 IN 24, QRSS, or a variety of other test patterns.
- Measure errors on T1 lines.

Figure 8 illustrates a T-BERD 224 connected to the span through the DSX-1 patch panel to loop the end equipment and tests the full T1 bandwidth.

1. **T1 circuit connections — See *Termination Test Setup - Recovered Timing***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 17 LOOP CD. Configure as shown.



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set according to network.

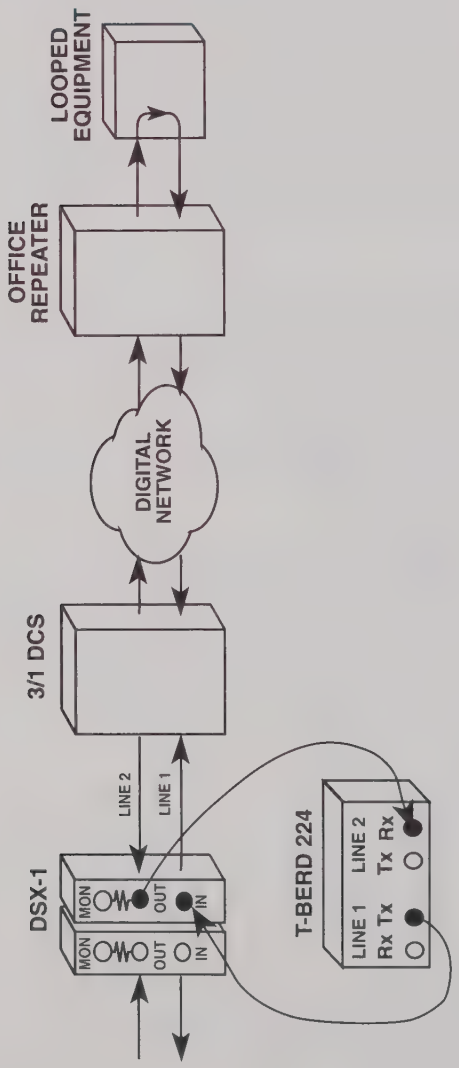


Figure 8
Loopback Testing

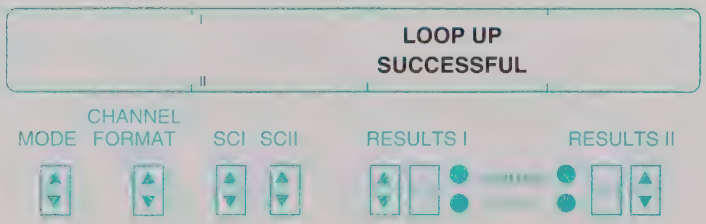
5. **CHANNEL FORMAT switch**
   Set to FULL T1.

6. **SCI switch**
   Set to the desired test pattern.

7. **DROP switch**
   Set to LINE 1.

8. **INSERT switch**
   Set to LINE 1.

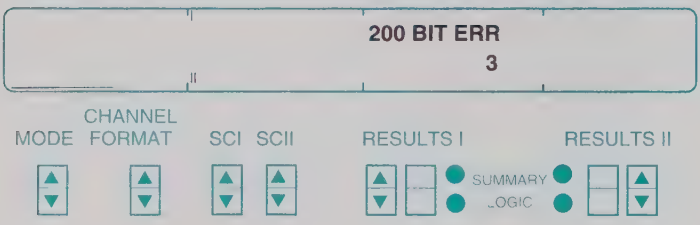
9. **LOOP UP switch**
   Press to send the loop-up code. The switch LED illuminates until the loop code is detected. When the loopback is established the test restarts.



10. **Local Status LEDs**
    Verify that the green Signal, Pattern, and Frame Sync (if applicable) LEDs are illuminated.

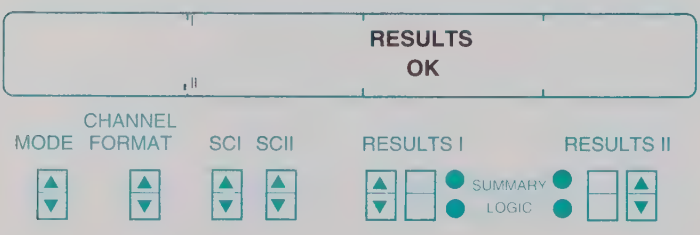
11. **RESULTS I switches**
    Select the SUMMARY category.

12. **LOGIC ERROR INSERT switch**
    Verify the loop by pressing this switch three times. Three bit errors should register in the n00-BIT ERR result.



13. **RESTART switch**
    Press to restart test and clear all results.

14. **RESULTS display**
    Check the SUMMARY category. Verify results are *OK*.



15. **Results interpretation**

FRM ERRORS, CRC ERRORS, BIT ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors at the test set.

FRM ERRORS, CRC ERRORS, BIT ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further.

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the transmission equipment timing or the network synchronization.

BIT ERRORS and BPVs

Check the last repeatered span before your present location. BPVs are present only on metallic loops and are removed before the data is retransmitted by most transmission equipment except repeaters.

BIT ERRORS only

Check the span before the DCS by isolating sections and testing.

Loopback is not established

The CSU is not operating correctly or the line from you to the CSU is bad.

Yellow Alarm LED

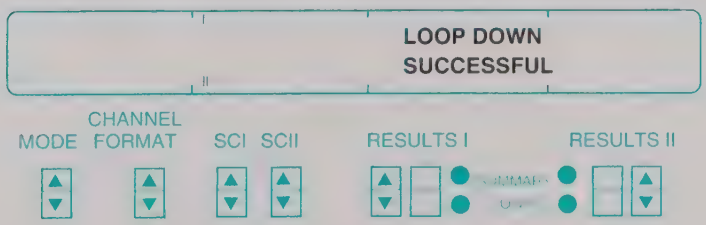
The far end will send a Yellow Alarm to indicate that it is not receiving a signal. Sectionalize the T1 equipment further.

AIS LED

This indicates that some equipment in the signal path towards your test set is not receiving a signal from the far end.

16. LOOP DOWN switch

When the test is completed, send a loop-down code to release the loopback. Disconnect the T-BERD 224 from span.



9. Emulate Smart Jacks/CSUs at Customer Premise *BERT Option Required*

- Verify the span installation.
- Terminate the T1 line and loop simplex current.
- Measure simplex current and T1 level.
- Auto-respond to T1 loop codes.
- Functionally replace a T1 CSU/Smart jack.

Figure 9 illustrates a T-BERD 224 emulating a CSU at the customer premises.

NOTE: If Bantam or 310 jacks are not available for testing at the customer premises, use test cables, such as the Model 41645 (dual bantam to RJ-48) or Model 41648 (dual bantam to 15-pin D-type male connector), to connect the T-BERD 224 to the network equipment or span line.

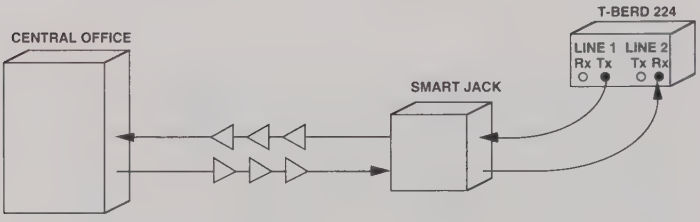
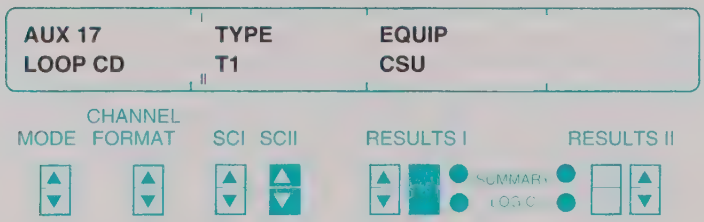


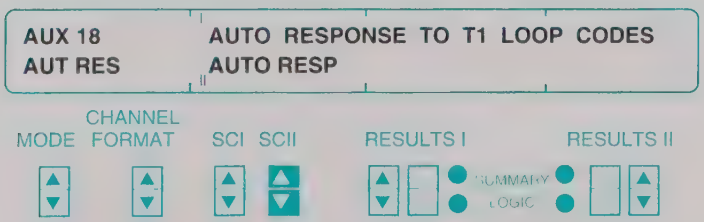
Figure 9
CSU/Smart Jack Emulation – Customer Premises Testing

1. **T1 circuit connections — See *Termination Test Setup - Internal Timing***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).
   Select AUX 17 LOOP CD. Configure as shown.



Select AUX 18 AUT RES. Configure as shown.



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set to AUTO.

5. **CHANNEL FORMAT switch**
   Set to FULL T1.

6. **SCI switch**
   Set to AUTO to autoconfigure to the pattern being sent from the CO.

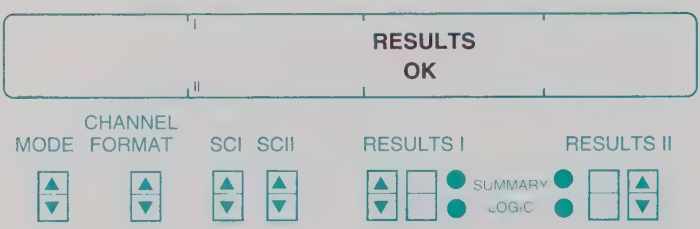
7. **DROP switch**
   Set to LINE 2.

8. **INSERT switch**
   Set to LINE 1.

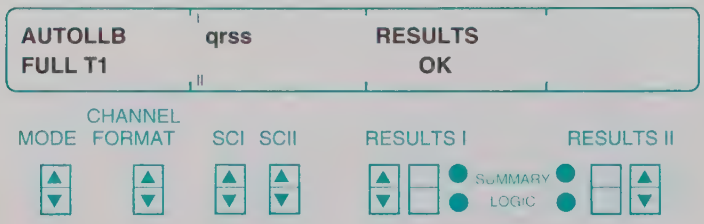
9. **RESTART switch**
   Press to restart test and clear all results.

10. **Local Status LEDs**
    Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

11. **RESULTS I switches**
    Check the SUMMARY category. Verify results are *OK*.



12. **CO sends CSU loop-up code to T-BERD 224**
    The T-BERD 224 responds in AUTO LLB mode. Internally the T-BERD 224 loops the LINE 2 Receive to the LINE 1 Transmit. The CSU is disconnected from the T1 span (idle code is transmitted to the CSU).



13. **Loopback verification**

Loopback successfully established, signal detected, frame sync achieved, and test pattern detected. Perform additional tests as required.

14. **Results interpretation**

FRM ERRORS, CRC ERRORS, BIT ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors at the test set.

FRM ERRORS, CRC ERRORS, BIT ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further.

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the local transmission equipment or synchronization in the network.

BIT ERRORS and BPVs

Check the last repeatered span before your present location. BPVs are present only on metallic loops and are removed before the data is retransmitted by practically every piece of transmission equipment except repeaters.

BIT ERRORS only

Check the span before the DCS by isolating sections and testing.

Loopback is not established

The span is bad or AUX 17 LOOP CD and AUX 18 AUT RES were not set up correctly.

15. **CO sends CSU loop-down code to T-BERD 224**

When the test is complete, the CO must send a loop down code to the T-BERD 224 to release the loopback. Disconnect T-BERD 224 from span and reconnect the CSU.

10. MULTIPAT and BRIDGTAP Loopback Testing
BERT Option Required

MULTIPAT

- Automated test contains five Bellcore approved test patterns.
- One-step qualification of T1 span lines.
- Patterns include QRSS, 1:7, 3 IN 24, All Ones, and 2 IN 8.

BRIDGTAP

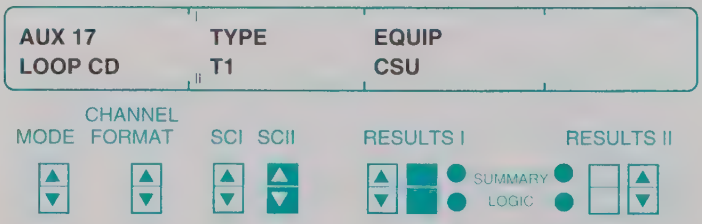
- Automated test detects the presence of most bridgetaps on T1 span lines.
- Transmits 21 patterns which are composed of varying degrees of ones and zeros densities.

Figure 10 illustrates the T-BERD 224 configured in a loopback to perform automated MULTIPAT and BRIDGTAP testing.

1. **T1 circuit connections — See *Termination Test Setup - Internal Timing***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 17 LOOP CD. Configure as shown to loop CSU.



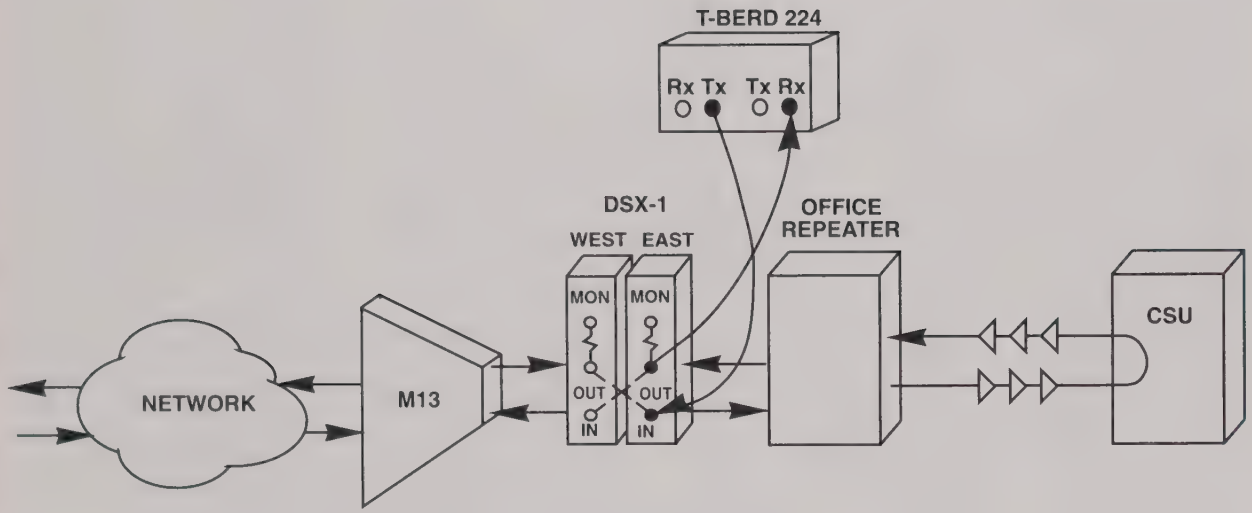


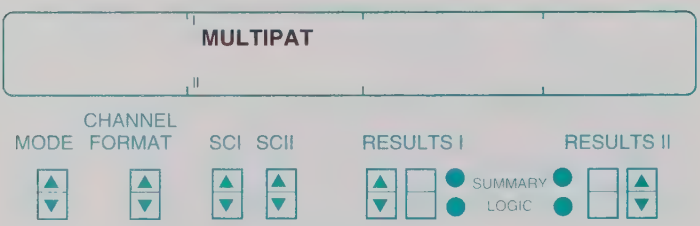
Figure 10
MULTiPAT and BRIDGTAP Testing

3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set according to network.

5. **CHANNEL FORMAT switch**
   Set to FULL T1.

6. **SCI switch**
   Set to MULTIPAT or to BRIDGTAP.

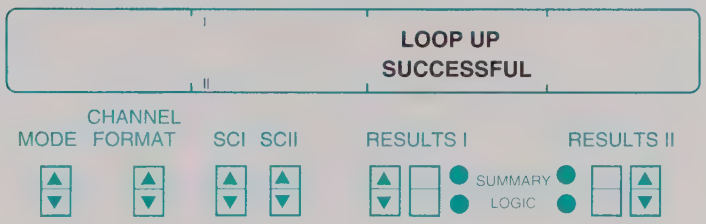


7. **CODE switch**
   Set to AMI or B8ZS (sets transmitter only).

8. **DROP switch**
   Set to LINE 2.

9. **INSERT switch**
   Set to LINE 1.

10. **LOOP UP switch**
    Press to send the loop-up code. The switch LED illuminates until loop code is detected. When the loopback is established the test restarts.



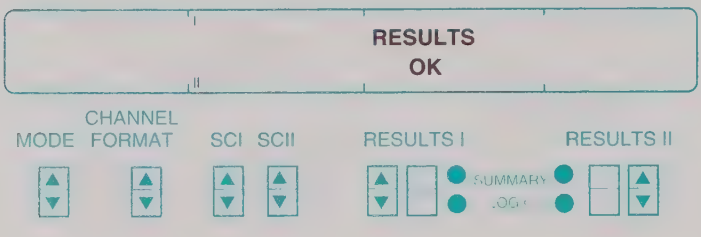
11. **Local Status LEDs**
    Verify that the green Signal, Pattern, and Frame Sync LEDs are illuminated.

12. **RESULTS I switches**
    Select the SUMMARY category.

13. **LOGIC ERROR INSERT switch**
    Verify the loop by pressing this switch three times. Three bit errors should register in the n00-BIT ERR result.

14. **RESTART switch**
    Press to restart test and clear all results.

15. **Results verification**
    Check the SUMMARY category. Verify results are *OK*.



16. **RESULTS interpretation — SUMMARY Category**

RESULTS OK — No errors were detected with the MULTIPAT and BRIDGTAP tests.

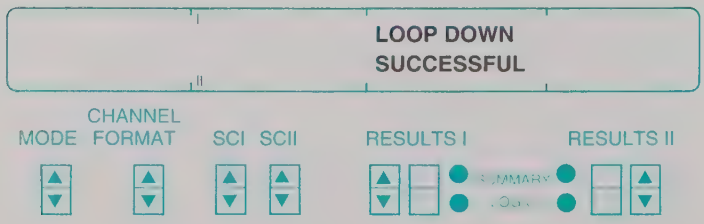
FAILED PAT — Test failed at the indicated test pattern.

Errored Results - MULTIPAT Errors — When all or part of the patterns fail it generally indicates a malfunctioning repeater, multiplexer, or DSX. The span requires further analysis and sectionalization.

Errored Results - BRIDGTAP Errors — When the errors are grouped around a number of patterns it indicates that a bridge taps exists on the span. Sectionalize the span to isolate the bridge taps.

17. **LOOP DOWN switch**

When the test is completed, send a loop-down code to release loopback. Disconnect the T-BERD 224 from span.



FRACTIONAL T1 TESTING

FT1 Performance Monitoring

FT1 Testing from the Customer Premise

FT1 Testing from the Central Office

FT1 Testing for Round Trip Delay

11. FT1 Performance Monitoring *BERT Option Required*

- Assists in sectionalizing FT1 circuit problems.
- Monitors FT1 test pattern from a mid-span location.

Use this application to test either a contiguous or non-contiguous fractional T1 bandwidth.

Figure 11 illustrates a T-BERD 224 monitoring a BERT test on a FT1 circuit.

1. **T1 circuit connections — See *Monitor Test Setup***

2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to 56 x N or 64 x N.

4. **SCI switch**
   Set to any BERT pattern.

Contiguous Channels

1. **SCII switch**
   Set N to the number of channels in the FT1 bandwidth.

2. **LINE 1 & 2 CHANNEL switch**
   Set to first channel of FT1 bandwidth.

Non-Contiguous Channels

1. **AUX switch**
   Press to access auxiliary functions (LED ON). Configure as shown.

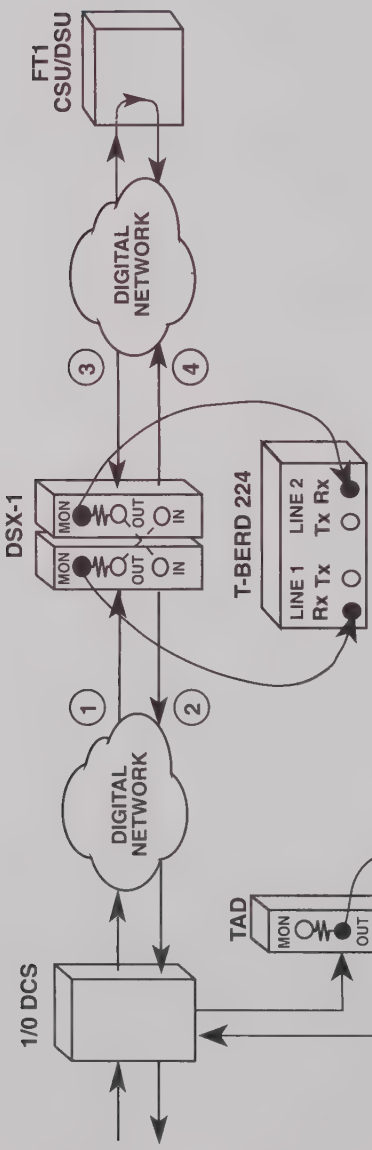
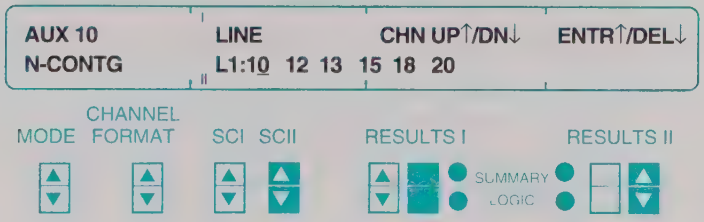


Figure 11
FT1 Performance Monitoring

Select AUX 10 N-CONTG. Line 1 and Line 2 must have the same quantity of channels - not necessarily the same channels.



2. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

3. **SCII switch**
   Set to NON CONTIG - Non-contiguous.

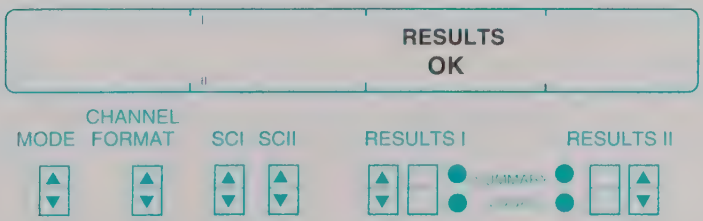
Testing

1. **DROP switch**
   Set to LINE 2.

2. **RESTART switch**
   Press to begin the test and clear results.

3. **Local Status LEDs**
   Verify that the green Signal, Frame Sync, and Pattern Sync LEDs are illuminated.

4. **RESULT I switches**
   Select SUMMARY Category. Verify results are *OK*.



5. **Results interpretation**

FRM ERRORS, CRC ERRORS, BIT ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors.

FRM ERRORS, CRC ERRORS, BIT ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment before they are introduced onto the span.

BIT ERRORS only

The local facility is operating correctly, however, the FT1 circuit is errored. Sectionalize further by checking the facilities, DCS configuration, FT1 circuit routing, or the customer premise equipment.

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the transmission equipment timing or the network synchronization.

Sectionalizing - The circled number references the location of the problem in Figure 11.

If LINE 2 is dropped with the T-BERD 224 not receiving errors and the BERT set receiving errors, then a problem exists between the T-BERD 224 and the DCS. (2)

If LINE 2 is dropped with the T-BERD 224 and the BERT set receiving errors, then the span needs to be sectionalized further by dropping LINE 1. (1) (3) (4)

If LINE 1 is dropped and the T-BERD 224 errors go away, then the problem exists between the T-BERD 224 and the CSU-DSU. (3) (4)

If LINE 1 is dropped and the errors for both test sets remain, then the problem exists between the DCS and the T-BERD 224. (1)

12. FT1 Testing From The Customer Premise *BERT Option Required*

- Qualify the FT1 circuit while allowing other DS0s to pass unaffected.
- Measure T1 signal parameters.

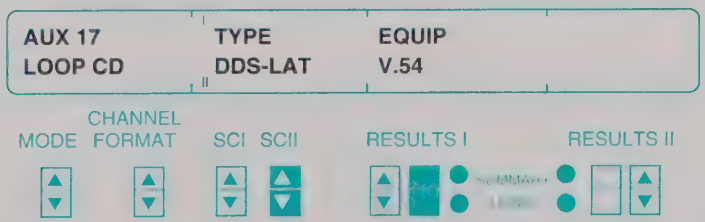
Figure 12 illustrates a T-BERD 224 testing a fractional T1 circuit from the customer premise.

NOTE: If DSX-1 patch panels are not available for testing at the customer premises use test cables, such as the Model 41645 (dual bantam to RJ-48) or Model 41648 (dual bantam to 15-pin D-type male connector), to connect the T-BERD 224 to the network equipment.

1. **T1 circuit connections — See *Drop and Inset Test Setup***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 17 LOOP CD. Select appropriate FT1 loop code (V.54, CSU, or DSU).



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

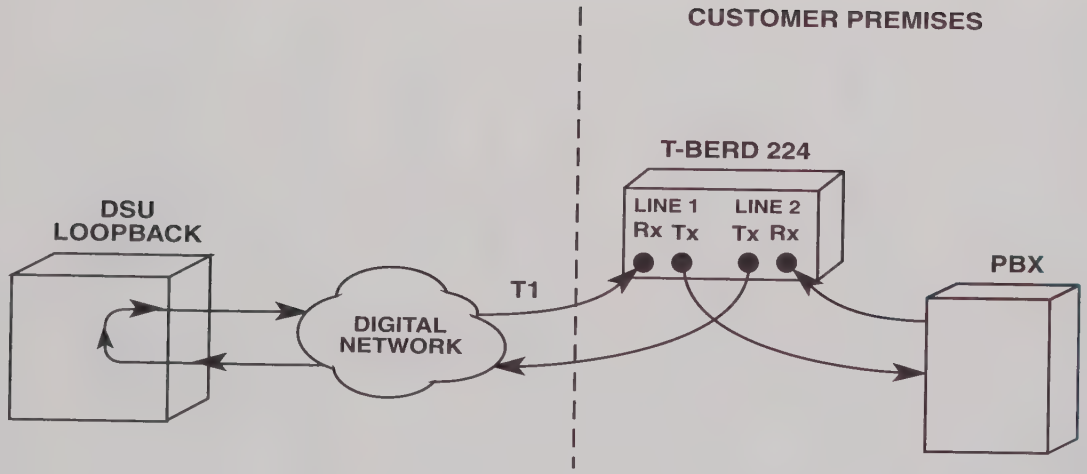


Figure 12
FT1 Customer Premise Testing

4. **MODE switch**
   Set to AUTO.

5. **CHANNEL FORMAT switch**
   Set to 56 x N or 64 x N.

6. **SCI switch**
   Set to any BERT pattern. 511 and 2047 are good FT1 stress patterns.

Contiguous Channels

1. **SCII switch**
   Set N to the number of channels in the FT1 bandwidth.

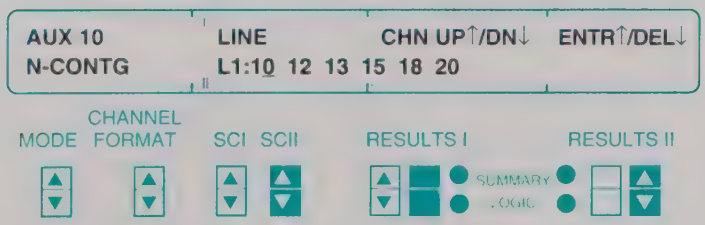
2. **LINE 1 & 2 CHANNEL switch**
   Set to first channel of FT1 bandwidth.

Non-Contiguous Channels

1. **SCII switch**
   Set to NON CONTIG - Non-contiguous.

2. **AUX switch**
   Press to access auxiliary functions (LED ON). Configure as shown.

   Select AUX 10 N-CONTG. Line 1 and Line 2 must have the same quantity of channels - not necessarily the same channels.



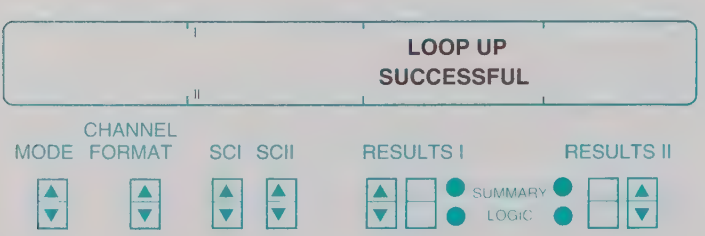
3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

Testing

1. **DROP switch**
   Set to LINE 1.

2. **INSERT switch**
   Set to LINE 2. Signal is inserted toward the network.

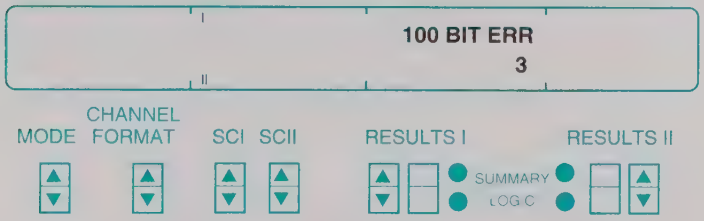
3. **LOOP UP switch**
   Press to send the loop-up code. The switch LED illuminates until loop code is detected. When the loopback is established the test restarts. If the far end does not respond to the loop code, create a hard loop at the terminal equipment.



4. **Local Status LEDs**
   Verify that the green Signal, Frame Sync, and Pattern Sync LEDs are illuminated.

5. **RESULTS I switches**
   Set to the SUMMARY category.

6. **LOGIC ERROR INSERT switch**
   Verify the loop by pressing this switch three times. Three bit errors should register in the n00 BIT ERR results.

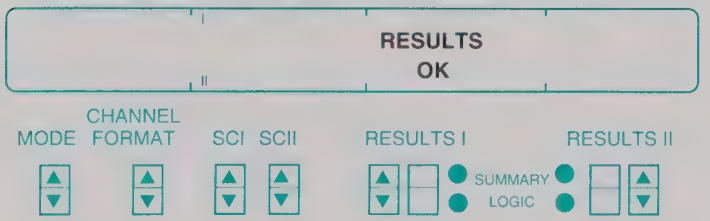


7. RESTART switch

Press to restart test and clear all results.

8. Results verification

Check the SUMMARY category. Verify results are *OK*.



9. Results interpretation

FRM ERRORS, CRC ERRORS, BIT ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

FRM ERRORS, CRC ERRORS, BIT ERRORS, No BPVs

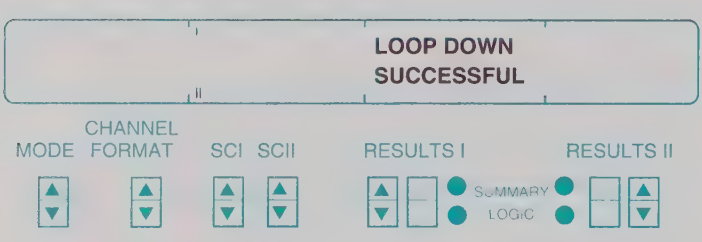
Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further downstream.

BIT ERRORS only

The local facility is operating correctly, however, the FT1 circuit is errored. Sectionalize further by checking the facilities, DCS configuration, FT1 circuit routing, or the customer premise equipment.

10. **LOOP DOWN switch**

When the test is completed, send a loop-down code to release the loopback. Disconnect the T-BERD 224 from span.



13. FT1 Testing From The Central Office
BERT Option Required

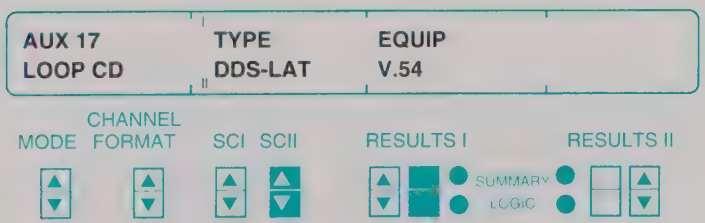
- Qualify the FT1 circuit from the mid-point to the customer premise.
- Test aggregate bandwidth on contiguous or non-contiguous channels 56 x N or 64 x N format.

Use this application to test either a contiguous or non-contiguous fractional T1 bandwidth.

Figure 13 illustrates a T-BERD 224 testing a FT1 circuit from the circuit midpoint to the customer premise.

1. **T1 circuit connections — See *Drop and Insert Test Setup/TAD Test Setup***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).
   Select AUX 17 LOOP CD. Select appropriate FT1 loop code (V.54, CSU, or DSU).



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set to AUTO.

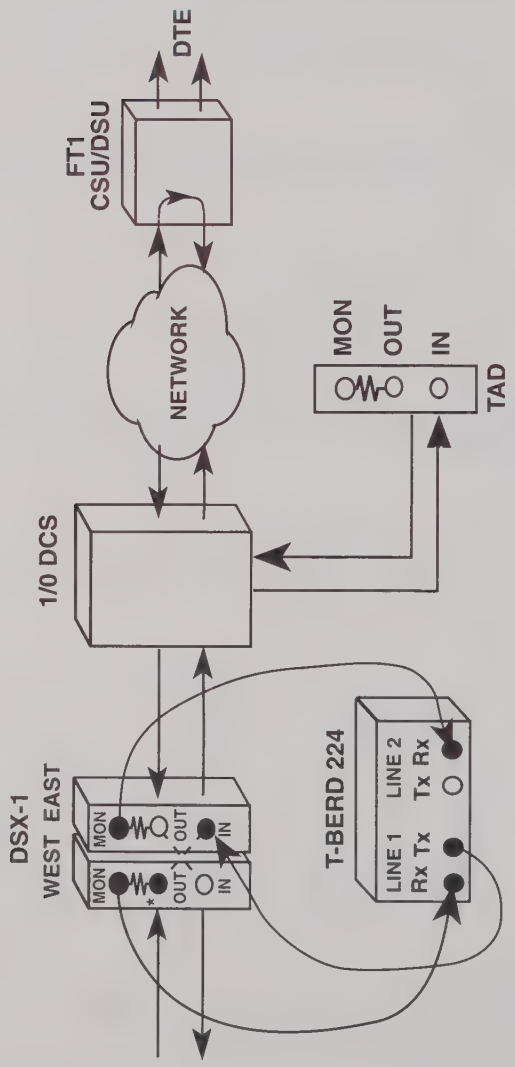


Figure 13
FT1 Central Office Testing

5. **CHANNEL FORMAT switch**
   Set to 56 x N or 64 x N.

6. **SCI switch**
   Set to any BERT pattern.

Contiguous Channels

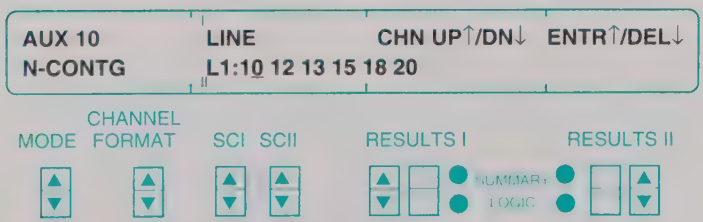
1. **SCII switch**
   Set N to the number of channels in the FT1 bandwidth.

2. **LINE 1 & 2 CHANNEL switch**
   Set to first channel of FT1 bandwidth.

Non-Contiguous Channels

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 10 N-CONTG. Line 1 and Line 2 must have the same quantity of channels - not necessarily the same channels.



2. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

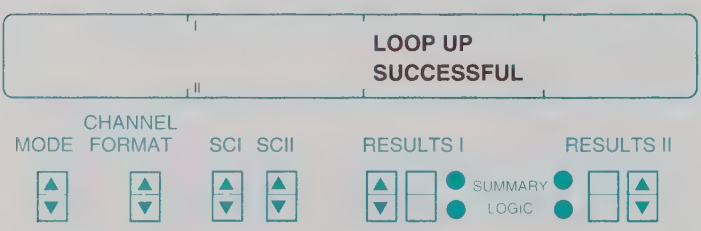
3. **SCII switch**
   Set to NON CONTIG - Non-contiguous.

Testing

1. **DROP switch**
   Set to LINE 2.

2. **INSERT switch**
   Set to LINE 1.

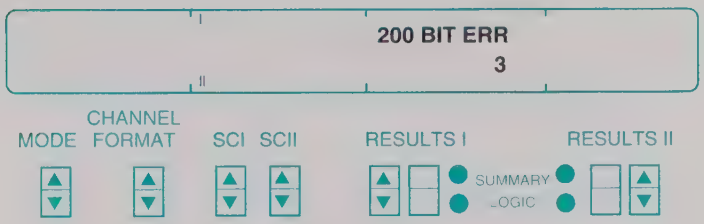
3. **LOOP UP switch**
   Press to send the loop-up code. The switch LED illuminates until the loop code is detected. When the loopback is established the test restarts.



4. **Local Status LEDs**
   Verify that the green Signal, Frame Sync, and Pattern Sync LEDs are illuminated.

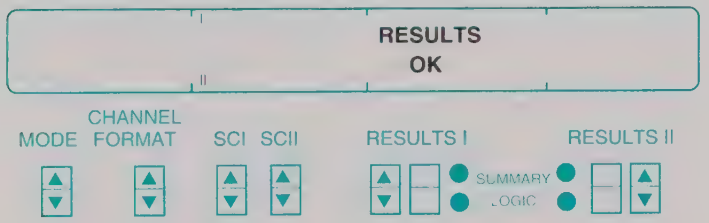
5. **RESULTS I switches**
   Select the SUMMARY category.

6. **LOGIC ERROR INSERT switch**
   Verify the loop by pressing this switch three times. Three bit errors should register in the n00 BIT ERR result.



7. **RESTART switch**
   Press to restart test and clear all results.

8. **RESULT display**
   Check the SUMMARY category. Verify results are *OK*.



9. **Results interpretation**

   FRM ERRORS, CRC ERRORS, BIT ERRORS, BPVs
   Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

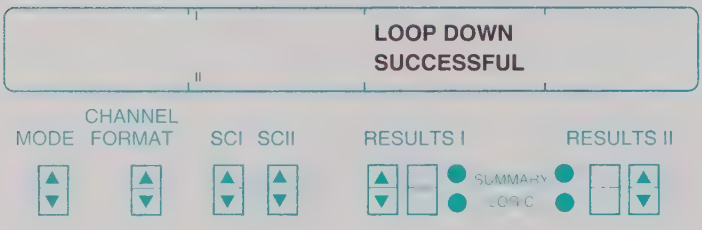
   FRM ERRORS, CRC ERRORS, BIT ERRORS, No BPVs
   Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further downstream.

BIT ERRORS only

The local facility is operating correctly, however, the FT1 circuit is errored. Sectionalize further by checking the facilities, DCS configuration, FT1 circuit routing, or the customer premise equipment.

10. **LOOP DOWN switch**

When test is complete, send a loop-down code to release the loopback. Disconnect T-BERD 224 from span.



14. FT1 Testing For Round Trip Delay
BERT Option Required

- Measure round trip delay on individual channels.
- Locate misrouted DS0s.

Figure 14 illustrates a T-BERD 224 measuring the round trip delay on a FT1 circuit.

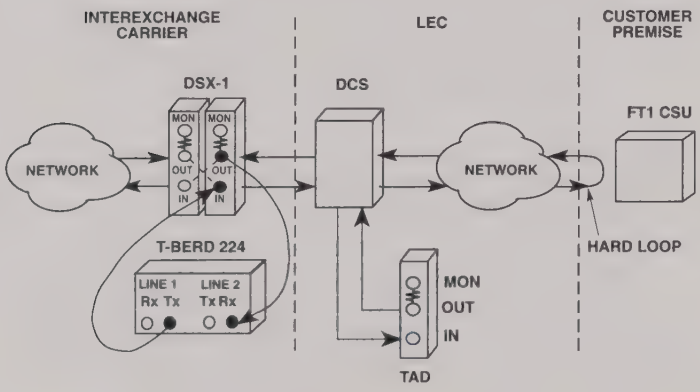


Figure 14
Round Trip Delay

1. **T1 circuit connections — See *Termination Test Setup***

2. **MODE switch**
   Set according to network.

3. **CHANNEL FORMAT switch**
   Set to DS0A56 or DS064.

4. **SCI switch**
   Set to $2^{15}-1$. This pseudorandom pattern is a good length for testing round trip delay.

5. **LINE 1 & 2 CHANNEL switches**
   Set to first channel of FT1 bandwidth.

6. **DROP switch**
   Set to LINE 2.

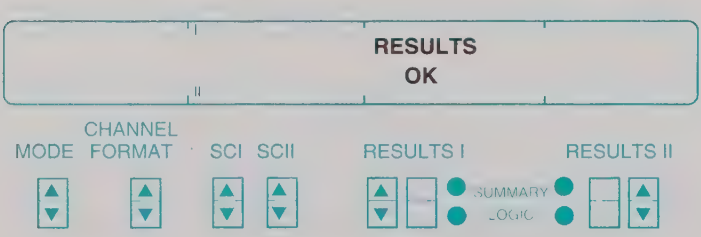
7. **INSERT switch**
   Set to LINE 1.

8. **LOOP FT1 CSU**
   Establish a hard loop at the FT1 CSU or follow the *Loopback Testing* procedures in the *FT1 Testing from the Central Office* application.

9. **RESTART switch**
   Press to restart test and clear all results.

10. **Local Status LEDs**
    Verify that the green Signal, Pattern Sync, and Frame Sync LEDs are illuminated.

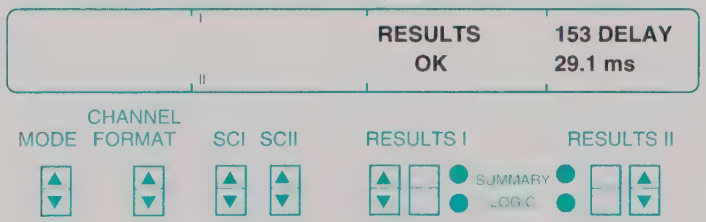
11. **RESULTS I switches**
    Check the SUMMARY category. Verify results are *OK*.



12. **LOGIC ERROR INSERT switch**
    To verify the loopback press this switch three times. Three bit errors should register in the n00 BIT ERR result.

13. **RESTART switch**
    Press to restart test and clear all results.

14. **RESULTS II switches**
    Select the SIGNAL category. Check the following results.



15. **Repeat this procedure for each channel of the FT1 bandwidth.**

16. **Results interpretation**
    The DELAY should be the same for each channel tested. If the DELAY is not the same, a DCS or another type of transmission equipment may have rerouted the signal.

SLC NETWORK TESTING

Monitoring SLC-96

Transmit and Receive SLC-96 Alarms

Verify Ring Generation and Circuit Continuity

Dialing into the Central Office Switch

Looping Testing the SLC Shelf Lines

15. Monitoring SLC-96
Enhanced SLC/ESF Option Required

- Mode 1 and Mode 2.
- Monitor the A shelf.
- Detect major, minor, power/misc alarms, protection switching, far-end loops, and maintenance activity.
- Find SLC-96 system problems independent of remote or central office terminal.

Figure 15 illustrates a T-BERD 224 connected to a SLC-96 system to monitor the A shelf.

For this application, LINE 1 monitors the signal from the CO Terminal and LINE 2 monitors the signal from the Remote Terminal. Alarms are identified with the line which they appear on.

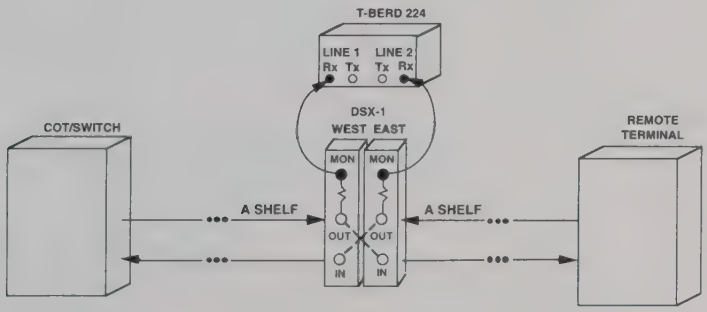


Figure 15
Monitoring the SLC-96 Datalink

1. **T1 circuit connections — See *Monitor Test Setup***
   Connect to A shelf.

2. **MODE switch**
   Set to AUTO. Verify "t1-slc96".

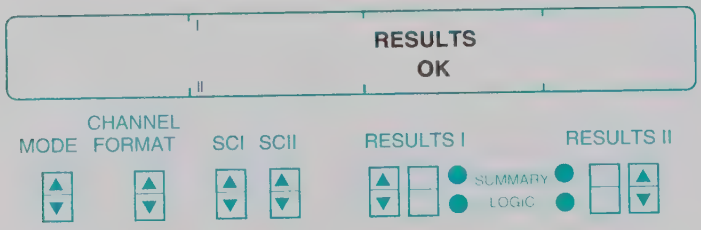
3. **CHANNEL FORMAT switch**
   Set to the applicable format.

4. **SCI and SCII switches**
   Not required for this test.

5. **RESTART switch**
   Press to restart test and clear all results.

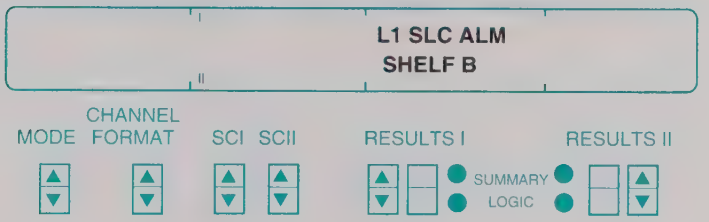
6. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

7. **RESULT switches**
   Select the SUMMARY Category. Check for alarms, maintenance activity, far-end loops, or line protection switching. Verify results are *OK*.



8. **Results interpretation**
   MAJOR ALARM
   The signal on the indicated shelf contains a service-affecting fault. The problem exists on the same line in the opposite direction.

   Example: A Major Alarm received on LINE 1 indicates that a problem exists on the signal transmitted into the CO.



MINOR ALARM

The signal on the indicated shelf contains a non-service-affecting fault. The problem exists on the same line in the opposite direction.

POWER/MISC

A physical problem exists in the remote terminal i.e., low battery, temperature, or open cabinet.

MAINTENENCE

Indicate that the bypass procedure is in progress.
MAINT TEST ALRM message indicates bypass sequence fails.
MAINT ON-HOOK message indicates the bypass initiated.
MAINT SEIZE message indicates the channel has been switched.
MAINT PROCEED message indicates the bypass is complete.

SWITCH TO PROTECT

The indicated shelf has been switched to the protect line.

FAR END LOOP

The indicated shelf has been looped back to itself.

16. Transmit and Receive SLC-96 Alarms

- Mode 1 and Mode 2.
- Verify system alarm response before turn-up.
- Simulates the A shelf of SLC-96 systems.
- Transmit major, minor, and power/miscellaneous alarms to remote terminals or COT/switches.

Figure 16 illustrates a T-BERD 224 connected to a DSX-1 to transmit alarms and test remote terminal response.

1. **T1 circuit connections — See *Termination Test Setup/Drop and Insert Test Setup***

2. **MODE switch**
   Set to T1SLC96 (for Mode 1).

3. **CHANNEL FORMAT switch**
   Set to DATLINK.

4. **SCI switch**
   Set to MAJOR ALRM.

5. **SCII switch**
   Set to SHELF A.

6. **LINE 1 & 2 CHANNEL switch**
   Not required for this test.

7. **DROP switch**
   Set to LINE 2.

8. **INSERT switch**
   Set to LINE 1.

9. **RESTART switch**
   Press to restart test and clear all results.

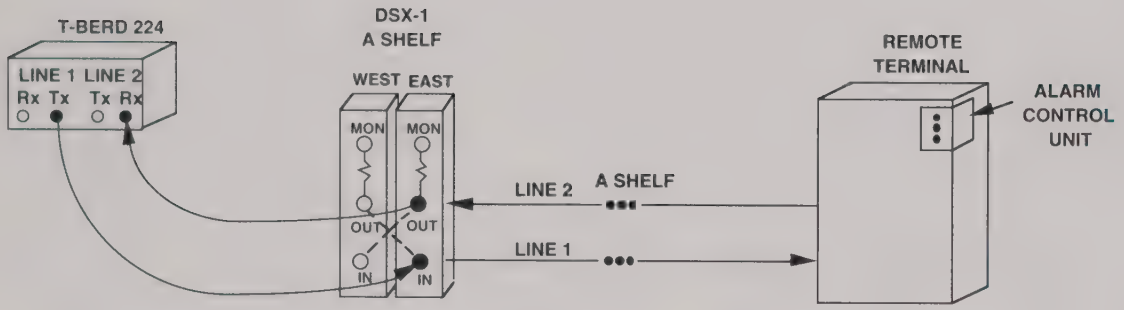
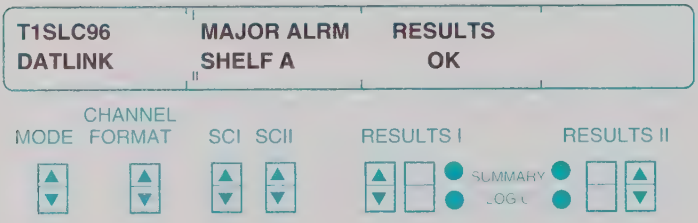


Figure 16
Transmit and Receive SLC-96 Alarms

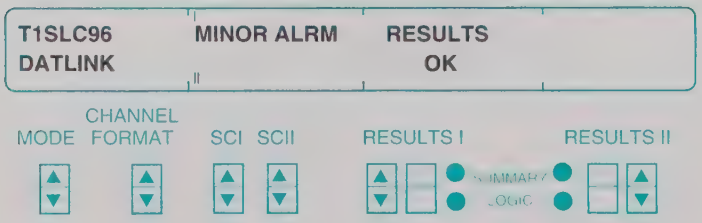
10. **Local Status LEDs**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

11. **RESULTS I switches**
    Select the SUMMARY Category. Verify the results are *OK*.



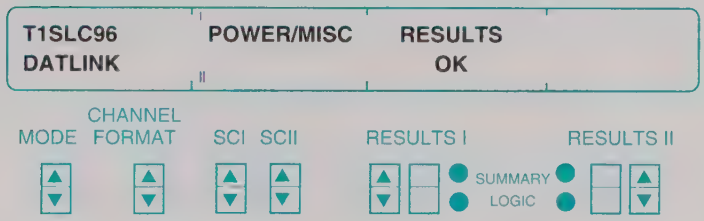
The Alarm Control Unit on the received terminal should indicate it has received a Major Alarm on the A shelf.

12. **SCI switch**
    Set to MINOR ALRM.



The Alarm Control Unit on the received terminal should indicate it has received a Minor Alarm.

13. **SCI switch**
Set to POWER/MISC.



The Alarm Control Unit on the received terminal should indicate it has received POWER/MISC Alarm on the A Shelf.

14. **Results interpretation**
If the LEDs on ACU do not indicate the alarms, a problem exists with the facility or with the line card in the terminal.

17. Verify Ring Generation and Circuit Continuity

- Mode 1 only.
- Verify the operation of the ring generator at the remote terminal.
- Test one or all 24 channels on a shelf.
- Transmit *Ringing Signal* (A=1, B=1/0) in the signaling bits.
- Talk across the T1 link using an external butt set connected to the T-BERD 224.

Figure 17 illustrates the T-BERD 224 connected to a DSX-1 to ring the remote terminal and verify the ring generation.

1. **T1 circuit connections — See *Termination Test Setup/Drop and Insert***

2. **MODE switch**
   Set to T1SLC96 (A shelf) or SLC-D1D (B, C, or D shelf).

3. **CHANNEL FORMAT switch**
   Set to VF.

4. **SCI switch**
   Set to VF INTF (if using butt set).

5. **LINE 1 & 2 CHANNEL switch**
   Set to T1 channel (1 to 24) to be tested.

6. **RESTART switch**
   Press to restart test and clear all results.

7. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

8. **RESULT I switches**
   Select the SUMMARY Category. Verify results are *OK*.

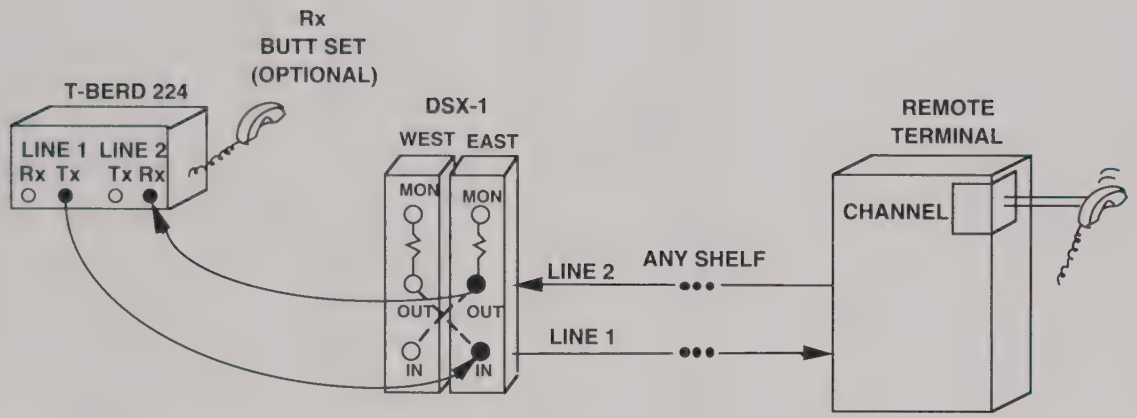
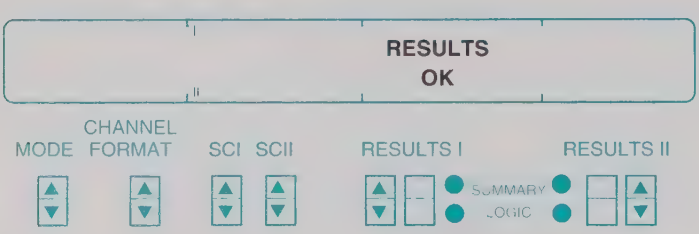


Figure 17
Verify Ring Generation



9. **DROP switch**
   Set to LINE 2.

10. **INSERT switch**
    Set to LINE1.

11. **A and B SIGNALING INSERT switches - send ringing**
    Set A to logic 1 (LED ON) and B to toggle between logic 1/0 (LED ON/OFF).

    NOTE: Systems signaling bits depend on the trunk type. See the Appendix Section of the *T-BERD 224 Reference Manual.*

12. **Results interpretation**
    At the remote terminal verify that ringing occurs on the selected channel. If the remote terminal station responds with an OFF-HOOK, a talk path is established between the T-BERD 224 and the remote terminal. You can now use a butt set to talk to the technician at the remote terminal.

    If ringing is not detected at the remote terminal, a problem exists with the facility or with the ring generator.

13. **A and B SIGNALING INSERT switches - remove ringing**
    Set A to logic 1 (LED ON) and B to logic 0.

    NOTE: Systems signaling bits depend on the trunk type.

14. **Butt set**
    Butt set can be used to talk across talk path.

18. Dialing Into The Central Office Switch

- Mode 1 only.
- Dial-through switch from T1 access point.
- Ensure that the switch correctly decodes the received digits.
- Verify the call setup procedures.
- Send *Off Hook* to switch using signaling insert (A=1, B=1).
- After dial tone, dial DTMF tones into switch.
- Talk across connection with optional butt-set.

The drop and insert test connections shown in Figure 18 illustrate how the T-BERD 224 connects to the span to allow the other VF channels to be passed through unaffected. It also shows a telephone butt set connected to the T-BERD 224 to allow 2-way voice access to the selected channel.

NOTE: Dialing into a switch may also be accomplished with the Signaling Option Keypad Lid.

1. **T1 circuit connections — See *Drop and Insert Test Setup/ Termination Test Setup***

2. **MODE switch**
   Set to T1SLC96 (A shelf) or SLC- D1D (B, C, or D shelf).

3. **CHANNEL FORMAT switch**
   Set to VF.

4. **SCI switch**
   Set to VF INTF.

5. **SCII switch**
   Not required for this test.

6. **LINE 1 & 2 CHANNEL switch**
   Set to T1 channel (1 to 24) to be tested.

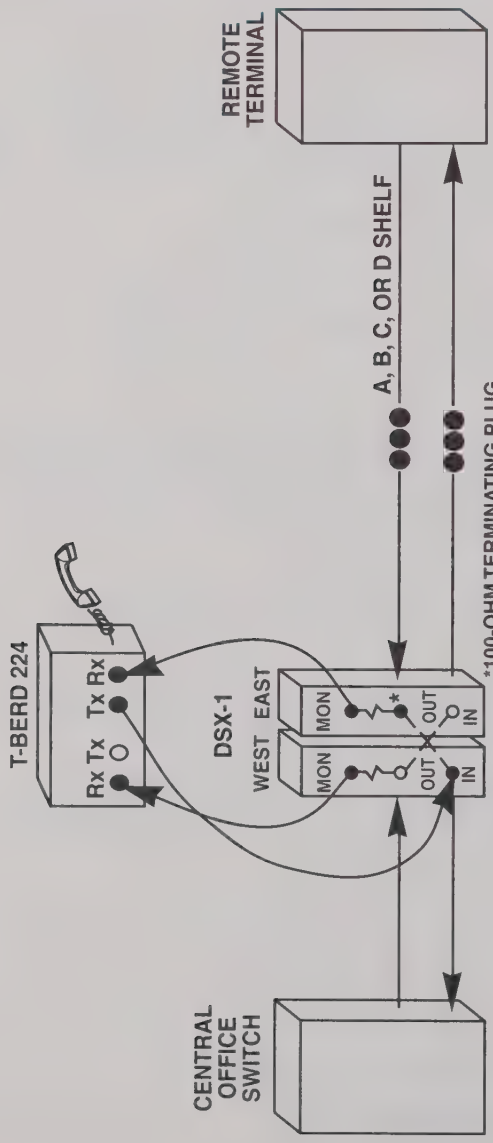


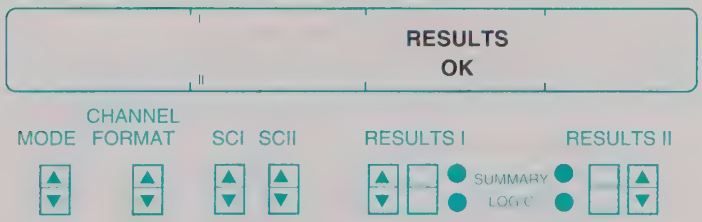
Figure 18
Dialing Into the CO Switch

7. **VOLUME switch**
   Set volume low.

8. **RESTART switch**
   Press to restart test and clear all results.

9. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

10. **RESULT I switches**
    Select the SUMMARY Category. Verify results are *OK*.



11. **Side panel VF 2-WIRE INTF terminals**
    Connect a telephone butt set to the two-wire posts.

12. **DROP switch**
    Set to LINE 1.

13. **Results verification**
    Verify the signaling bits on the channel to be tested are idle by using the Signaling LEDs. Monitor the signaling activity from the CO by listening to the selected channel on the T-BERD 224 speaker.

14. **INSERT switch**
    Set to LINE 2. This allows 2-way access to the telephone butt set.

15. **A and B SIGNALING INSERT switches**
Set A to logic 1 (LED ON) and B to logic 1 (LED ON). Dial tone should be heard immediately.

NOTE: The signalling bits are different for loop and ground start lines. See Section 3 of the *T-BERD 224 Reference Manual.*

16. **Telephone butt set**
- Verify that dial tone is heard.
- Dial test telephone number.
- Verify ring back and far-end party answering call.
- A talk path is now established between the T-BERD 224 butt set and the called party.

17. **A and B SIGNALING INSERT switches**
Set A to logic 0 (LED OFF) and B to logic 0 (LED OFF). Line is returned to ON HOOK.

18. **Results interpretation**
If the call is not established between the test set and the switch, possible sources of problem are transmission path, line card in the COT, or the switch translation.

19. Looping and Testing SLC Shelf Lines
Enhanced SLC/ESF Option Required

- Loop B, C, D and Protection Line in Mode 1 and Mode 2.
- Test the transmission facility without accessing the switch terminal.
- Loop up the selected shelf, automatically switching it to the protection line.
- Perform BERT testing on the looped shelf with an external test set.

Figure 20 illustrates a T-BERD 224 connected to a SLC-96 system DSX-1 patch panel. The T-BERD 224 is configured to loop the selected shelf (Shelf C for this example) and test the looped shelf with an external test set, like the T-BERD 209A.

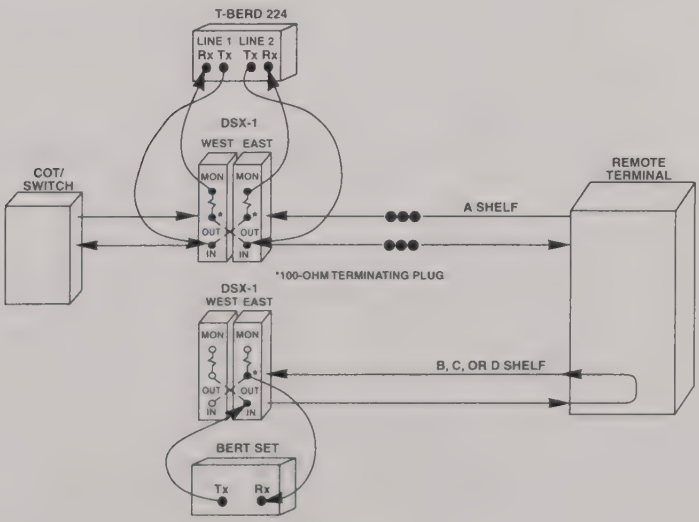


Figure 19
BERT the Switched Shelf

1. **T1 circuit connections — See *Drop and Insert Test Setup (Connect to A shelf)***

2. **MODE switch**
   Set to T1SLC96 (Mode 1).

3. **CHANNEL FORMAT switch**
   Set to DATLINK.

4. **SCI switch**
   Set to FAR END LP.

5. **SCII switch**
   Set to Shelf C to loop Shelf C.

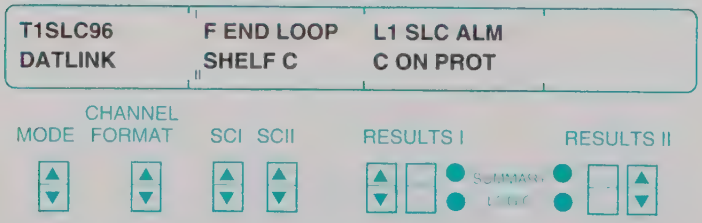
6. **DROP switch**
   Set to LINE 2.

7. **RESTART switch**
   Press to restart test and clear all results.

8. **INSERT switch**
   Set to LINE 1. The Switch to Protect and Shelf loop codes are now transmitted over the A Shelf datalink. Shelf Cis switched to the protection line and looped.

9. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

10. **RESULTS I switches**
    Select SUMMARY category. Verify alarm message. The message shown below indicates Shelf C was switched to protect and looped.



If the SLC ALM PROT message is not displayed do not proceed: the protection line may not be available, the shelf may already be switched to protect, or a problem may exist with the transmission facility or the remote terminal.

11. **Additional BERT set**

Upon successful loop up, the shelf is available for BER testing.

ESF NETWORK TESTING

Monitoring PRMs

Transmit and Receive PRMs

ESF Loopback Test

20. Monitoring PRMs
Enhanced SLC/ESF Option Required

- Perform full-duplex in-service error analysis on T1 circuits.
- Monitor ANSI T1.403 performance report messages generated by ESF-CSUs.

Figure 20 illustrates the T-BERD 224 monitoring a T1 circuit for PRMs.

1. **T1 circuit connections — See *Monitor Test Setup***

2. **MODE switch**
   Set to AUTO. Verify "t1-esf".

3. **CHANNEL FORMAT switch**
   Not required for this test.

4. **SCI and SCII switches**
   Not required for this test.

5. **DROP switch**
   Set to LINE 1.

6. **INSERT switch**
   Set to NONE.

7. **RESTART switch**
   Press to restart test and clear all results.

8. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

9. **RESULTS I switches**
   Select the SUMMARY category. Verify results are *OK*.

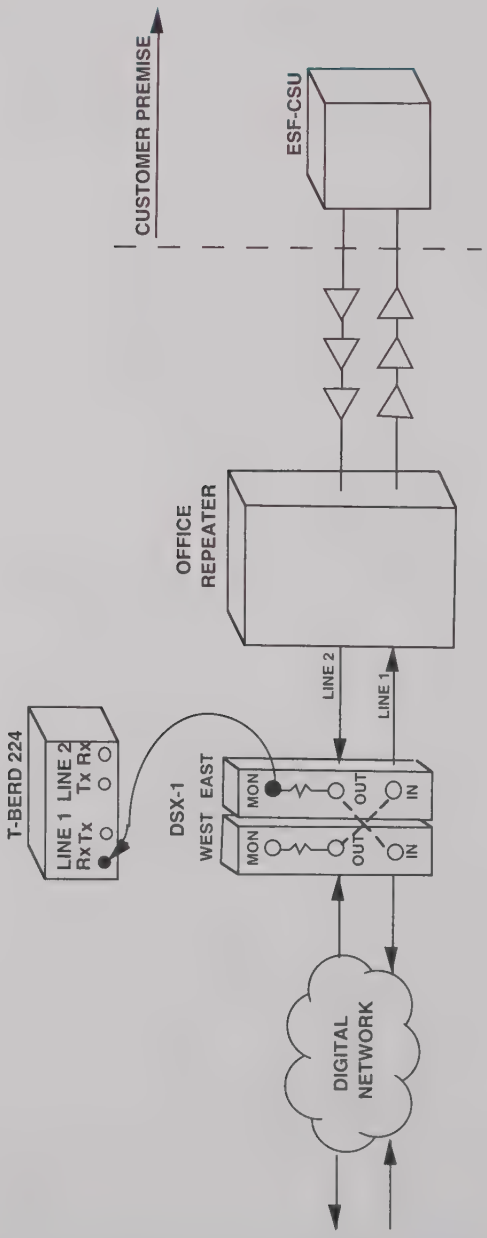
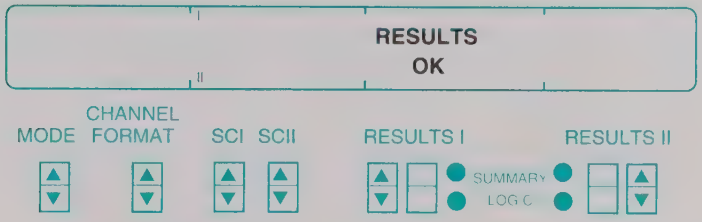


Figure 20
Monitoring T1 Circuit



10. Results interpretation

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

F CRC Error, FBPV S, F FR ES, F SLP S

Problem is on the line received at the customer's CSU.

FRM ERRORS, CRC ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further downstream.

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the transmission equipment timing or the network synchronization.

RX LVL

The received level should be -20 dB +/- 3 dB at resistor isolated DSX-MON jacks. Incorrect levels could be caused by a facility T1 line card or poor cabling between the DSX jack and the equipment.

Yellow Alarm LED

The far end will send a Yellow Alarm to indicate that it is not receiving a signal. Sectionalize the T1 equipment further.

AIS LED

This indicates that some equipment in the signal path towards your test set is not receiving a signal from the far end.

21. Transmit and Receive PRMs
Enhanced SLC/ESF Option Required

- Determine the quality of the ESF facility at the customer premise.
- Generate PRMs based on the received signal.

Figure 21 illustrates a T-BERD 224 connected in front of the CSU.

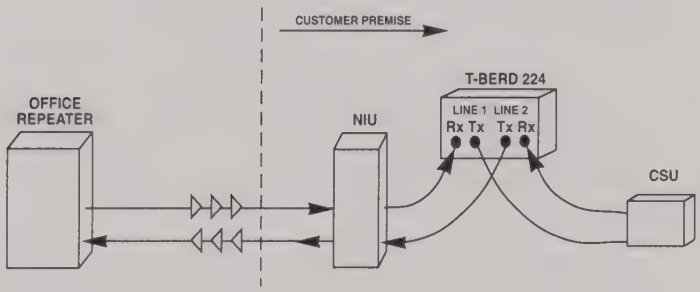
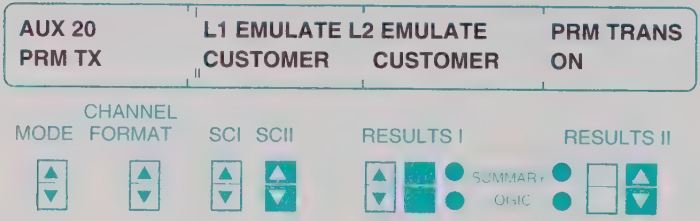


Figure 21
Transmitting and Receiving PRMs

1. **T1 circuit connections — *Drop and Insert Test Setup***
   Connect the T-BERD 224 in front of the CSU. If the CSU does not have PRM capability, the T-BERD 224 provides it.

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 20 PRM TX. Configure as shown.



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set to T1-ESF.

5. **CHANNEL FORMAT switch**
   Set to FULL T1.

6. **SCI and SCII switches**
   Not required for this test.

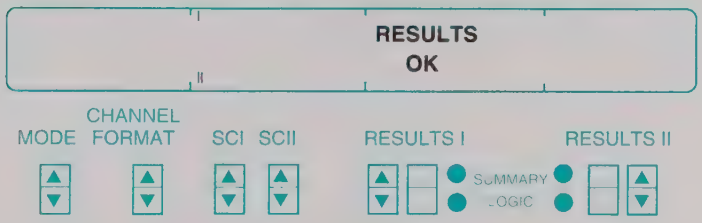
7. **DROP switch**
   Set to BOTH.

8. **INSERT switch**
   Set to NONE.

9. **RESTART switch**
   Press to begin the test and clear results.

10. **Local Status LEDs**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

11. **RESULT I switches**
    Select the SUMMARY Category. Verify results are *OK*.



12. **Results interpretation**

If the test equipment in the CO detects far end errors, the transmission facility to the customer premise is errored.

22. ESF Loopback Test
BERT Option Required

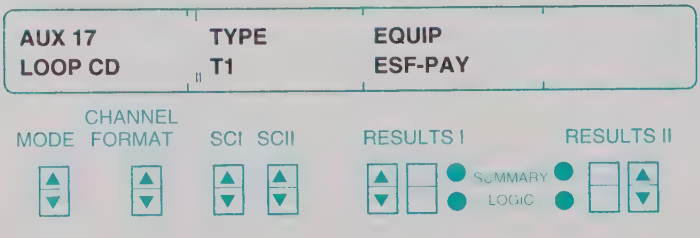
- Loop ANSI T1.403 compatible CSUs and smart jacks.
- End-to-end BERT testing.

Figure 22 illustrates a T-BERD 224 connected to the span through the DSX-1 patch panel to loop a ESF-CSU through the datalink.

1. **T1 circuit connections — See *Termination Test Setup - Internal Timing***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 17 LOOP CD. Select ESF-PAY or ESF-LIN depending on the application.



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set to T1-ESF.

5. **CHANNEL FORMAT switch**
   Set to FULL T1.

6. **SCI switch**
   Set to the desired test pattern.

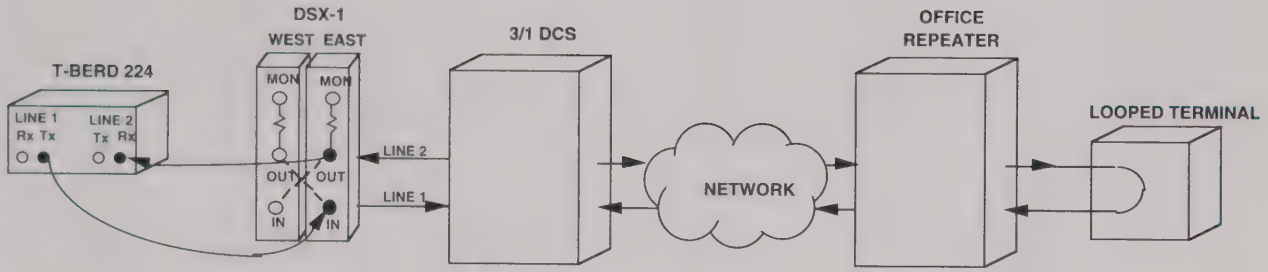
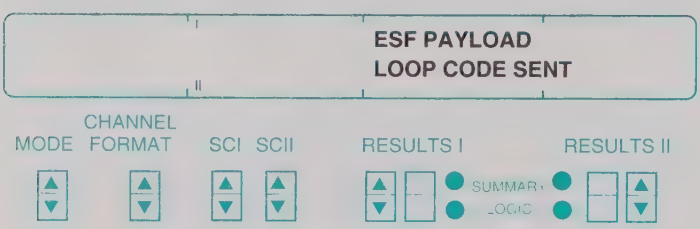


Figure 22
ESF Loopback Test

7. **DROP switch**
   Set to LINE 2.

8. **INSERT switch**
   Set to LINE 1.

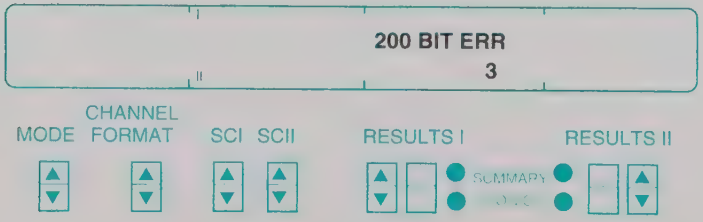
9. **LOOP UP switch**
   Press to send the loop-up code. The switch LED illuminates until loop code is detected. When the loopback is established the test restarts.



10. **Local Status LEDs**
    Verify that the green Signal, Frame Sync, and Pattern Sync LEDs are illuminated.

11. **RESULTS I switches**
    Select the SUMMARY category.

12. **LOGIC ERROR INSERT switch**
    Verify the loop by pressing this switch three times. Three bit errors should register in the n00-BIT ERR result.

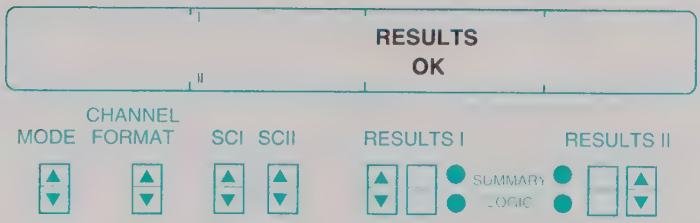


13. RESTART switch

Press to restart test and clear all results.

14. Results verification

Select the SUMMARY category. Verify the results are *OK*.



15. Results interpretation

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors.

F CRC E, F BPV S, F FR ERRORS, or F SLP S

A problem exists with the transmission path to the customer.

FRM ERRORS, CRC ERRORS, BIT ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors at the test set.

FRM ERRORS, CRC ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further.

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the local transmission equipment or synchronization in the network.

BPVs and BIT ERRORS

Check the last repeatered span before your present location. BPVs are present only on metallic loops and are removed before the data is retransmitted by practically every piece of transmission equipment except repeaters.

BIT ERRORS only

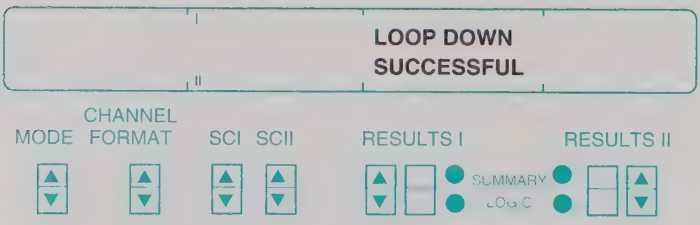
Check the span before the DCS by isolating sections and testing.

Loopback is not established

The CSU is not operating correctly or the line from you to the CSU is bad.

16. **LOOP DOWN switch**

When the test is completed, send a loop-down code to release loopback. Disconnect the T-BERD 224 from span.



DDS NETWORK TESTING

Monitoring DDS Network

Analyzing a Data Channel's Protocol

DDS Loopback Testing

Testing MJU Controls

23. Monitoring DDS Network

- Sectionalize DDS channel problems.

Figure 23 illustrates a T-BERD 224 monitoring a DDS network.

1. **T1 circuit connections — See *Monitor Test Setup***

2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to the appropriate DS0A or DS0B data rate.

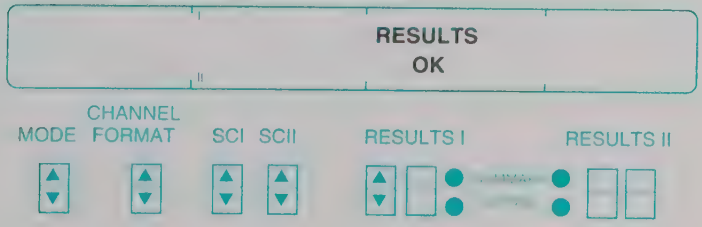
4. **SCII switch**
   If DS0B — Set subrate data channel.

5. **LINE 1 & 2 CHANNEL switch**
   Set to the channel (1 to 24, ALL) under test.

6. **RESTART switch**
   Press to begin the test and clear results.

7. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

8. **RESULT I switches**
   Select SUMMARY Category. Verify results are *OK*.



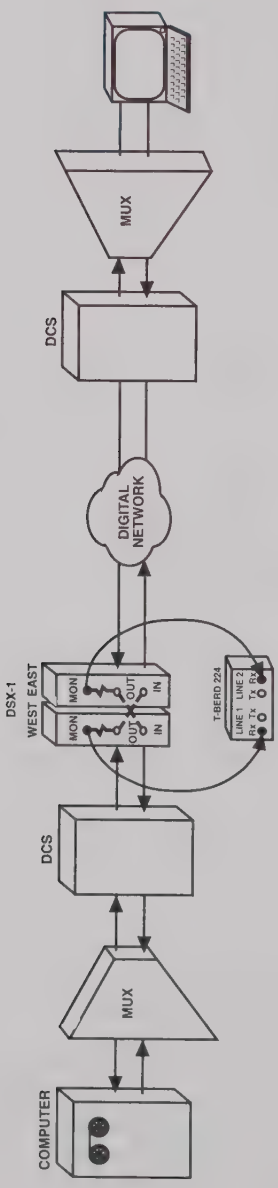


Figure 23
DDS Monitoring

9. **Results interpretation**

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

FRM ERRORS, CRC ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further downstream.

RX FREQ Hz

The received frequency should be 1.544 MHz +/- 75 Hz. If the frequency is outside of the specification, check the transmission equipment timing or the network synchronization.

RX LVL

The received level should be -20 dB +/- 3 dB at resistor isolated DSX-MON jacks. Incorrect levels could be caused by a facility T1 line card or poor cabling between the DSX jack and the equipment.

Yellow Alarm LED

The far end will send a Yellow Alarm to indicate that it is not receiving a signal. Sectionalize the T1 equipment further.

AIS LED

This indicates that some equipment in the signal path towards your test set is not receiving a signal from the far end.

24. Analyzing a Data Channel's Protocol
DSU-DP Option Required

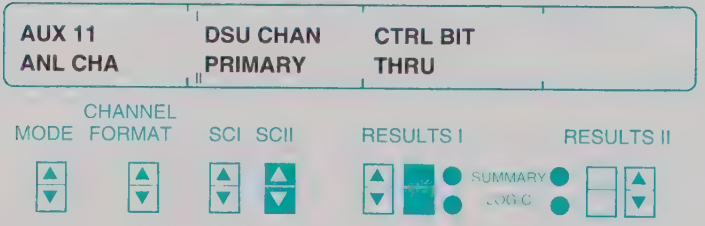
- Isolate dropouts which are occurring somewhere within the network.
- Detect transmission and protocol problems within the network.
- Measure throughput on a data channel.
- Verify ACK/NAK receptions in both transmissions directions.
- Bit 8 - Indicates when RTS is active.

Figure 24 illustrates a T-BERD 224 collecting the results for analyzing a data channel's protocol.

1. **T1 circuit connections — See *Monitoring Test Setup***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 11 ANL CHA. Configure as shown to analyze the primary channel.



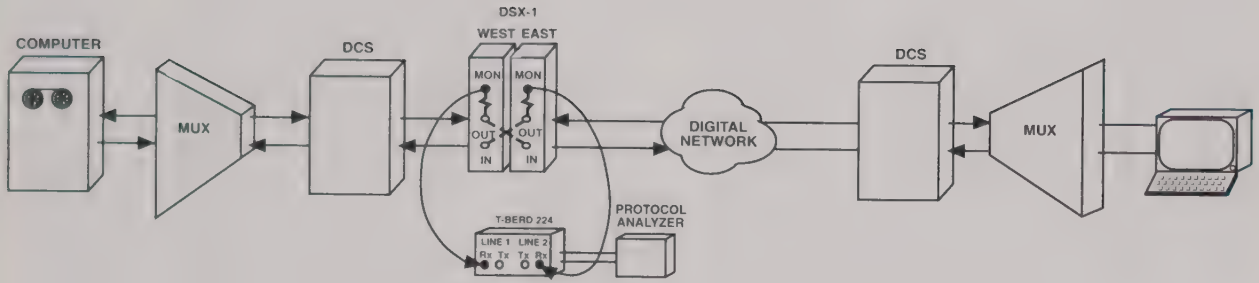
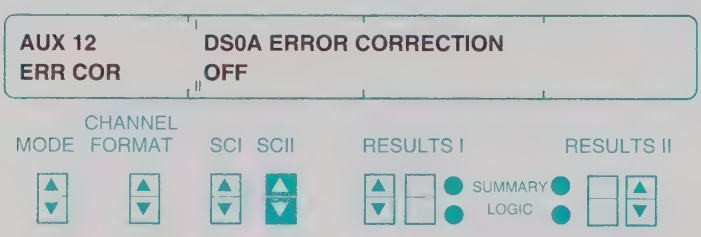


Figure 24
Analyzing a Data Channel's Protocol

Select AUX 12 ERR COR. Configure as shown to disable majority rule error correction.



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set to AUTO.

5. **CHANNEL FORMAT switch**
   Set to the appropriate DS0A or DS0B data rate.

6. **SCI switch**
   Set to DSU-DP.

7. **SCII switch**
   If DS0B — Set subrate data channel.

8. **DROP switch**
   Set to BOTH.

9. **INSERT switch**
   Set to NONE.

10. **LINE 1 & 2 CHANNEL switches**
    Set to the channel (1 to 24) under test.

11. **DSU-DP Option interfaces**
    Using a cable such as Model 31141, Model 31142, or Model 31143 connect an external protocol analyzer or data scope test set to the appropriate DSU-DP Option interface.

12. RESTART switch

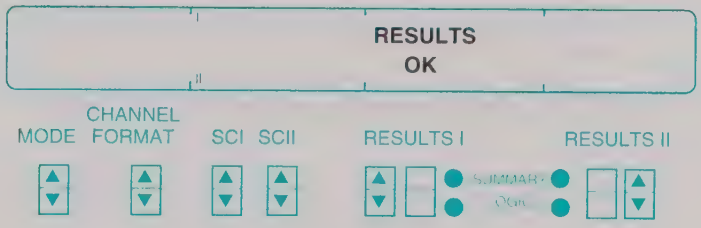
Press to begin the test and clear results.

13. Local Status LEDs

Verify that the green Signal and Frame Sync LEDs are illuminated.

14. RESULT I switches

Select SUMMARY Category. Verify results are *OK*.



15. Protocol analyzer

Configure the protocol analyzer or data scope to the appropriate data rate, parity, protocol, etc. Set the protocol analyzer timing to be received from the T-BERD 224 DSU-DP data port.

16. Results interpretation

To interpret the data protocols throughput, the response time, etc., refer to the protocol analyzers operating manual.

The status of Bit 8 indicates when the DTE (at the customer premise) is activating the Request To Send. The status of the DSU-DP's RLSD lead indicates the Bit 8 status of LINE 1. The signaling lead indicates the Bit 8 status of LINE 2 [V.35 interface pin LL, RS-232 interface pin 12, RS-449 pin 34 (B lead) and pin 32 (A lead)].

FRM ERRORS, CRC ERRORS, BPVs
Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

DDS F E only
Local T1 span problem.

No FRM ERRORS, CRC ERRORS, or BPVs
The DS0B MUX is not working properly.

Protocol Analyzer Errors, No FRM ERRORS, CRC ERRORS, BPVs
A problem may exist with the DSU-CSU, DS0-DP, or in the local loop. A problem does not exist with the DDS network.

25. DDS Loopback Test
BERT Option Required

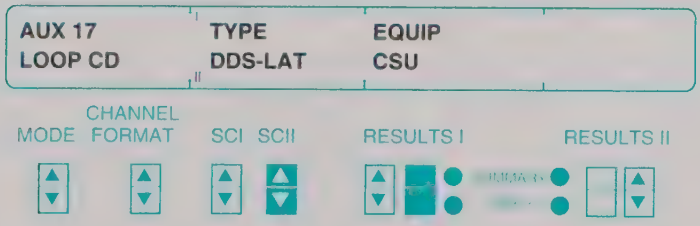
- Test DS0A (2.4..56 kb/s) and DS0B (2.4...9.6) circuits.
- Send alternating and latching DDS loop codes.
- Test with 63, 511, 2047 or DDS stress patterns.
- Test primary or secondary channels.

Figure 25 illustrates the T-BERD 224 establishing a latching loopback at a DDS CSU to test an individual DDS channel.

1. **T1 circuit connections — See *Drop and Insert Test Setup/TAD Test Setup***

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 17 LOOP CD. Configure as shown.



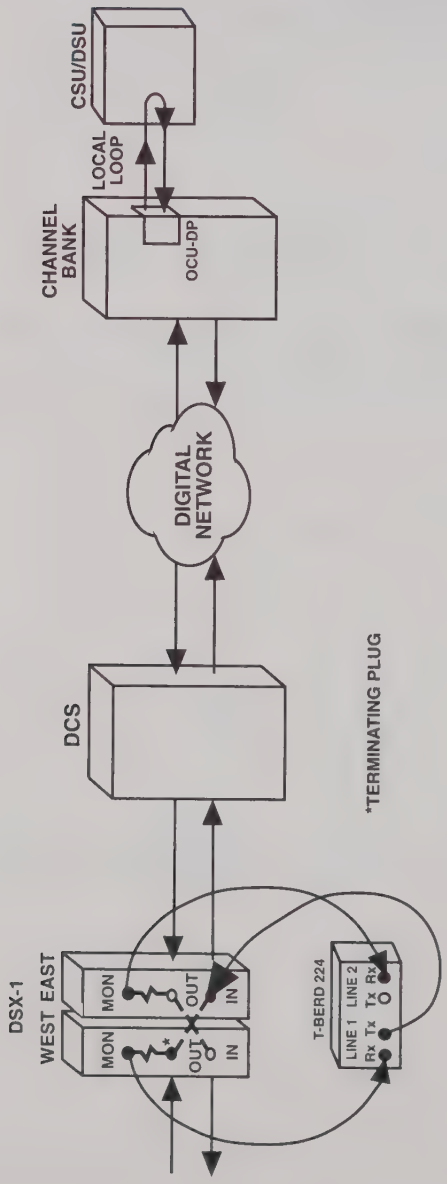
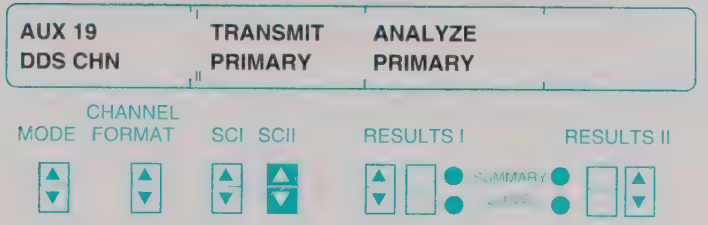


Figure 25
DDS Loopback

Select AUX 19 DDS CHN. Configure as shown.



3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **MODE switch**
   Set to AUTO.

5. **CHANNEL FORMAT switch**
   Set to the appropriate DS0A or DS0B data rate.

6. **SCI switch**
   Set to any BERT pattern.

7. **SCII switch**
   If DS0B — Set subrate data channel.

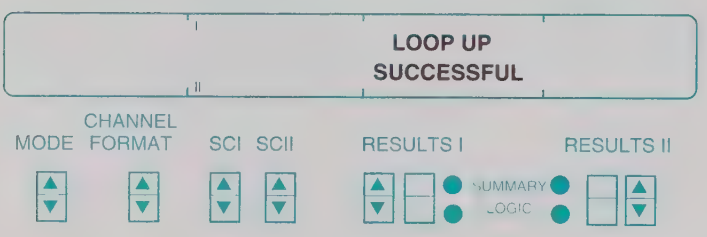
8. **LINE 1 & 2 CHANNEL switches**
   Set to the channel under test.

9. **DROP switch**
   Set to LINE 2.

10. **INSERT switch**
    Set to LINE 1.

11. LOOP UP switch

Press to send the loop-up code. The switch LED illuminates until the loop code is detected. When the loopback is established, the test restarts. If CSU does not loop up with a latching loop code, send an alternating loop code.

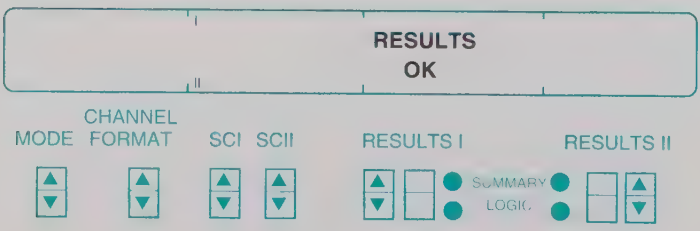


12. Local Status LEDs

Verify that the green Signal, Pattern Sync, and Frame Sync LEDs are illuminated. If the Pattern Sync LED does not illuminate, or if bit errors occur, recheck AUX 19 to verify DDS channels being tested.

13. RESULTS I switches

Select the SUMMARY category. Verify results are *OK*.



14. LOGIC ERROR INSERT switch

Verify the loop by pressing this switch three times. Three bit errors should register in the n00-BIT ERR result.

15. **RESTART switch**

Press to restart test and clear all results.

16. **Results interpretation**

FRM ERRORS, CRC ERRORS, BPVs, DDS F E

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

DDS F E and BIT ERRORS only

Far T1 span problem. DCS will remove FRM ERRORS, CRC ERRORS, and BPVs.

DDS F E only

Problem exists with the DSOB MUX.

BIT ERRORS and BPVs

Check the last repeatered span before your present location. BPVs are present only on metallic loops and are removed before the data is retransmitted by practically every piece of transmission equipment except repeaters.

BIT ERRORS only

Check the local loop or one of the channel cards in the network. Sectionalize the network by establishing loopbacks at different locations, Ex: OCU, DS0-Data Port.

FRM ERRORS, CRC ERRORS, No BPVs

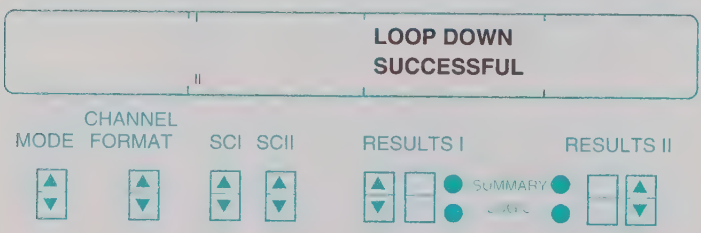
Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further.

Loopback is not established

The CSU is not operating correctly or the line from you to the CSU is bad.

17. **LOOP DOWN switch**

When the test is completed, send a loop-down code to release loopback. Disconnect the T-BERD 224 from span.



26. Testing MJU Controls
BERT Option Required

- Control single or cascaded MJUs.
- Loop equipment off selected branch and perform BERT tests.
- Test the SELECT, BLOCK, UNBLOCK, RELEASE and RESTORE commands.

  SELECT — places the MJU in a test mode. Test data and commands are conveyed only to the selected branch. The three other branches are temporarily blocked.

  BLOCK — stops a branch from receiving and transmitting data. A BLOCK operation may be performed after the branch has been SELECTed. A BLOCK is cleared by either an UNBLOCK or a RELEASE operation.

  UNBLOCK — allows a BLOCKed branch to receive and transmit data. An UNBLOCK operation may be performed after the branch has been SELECTed. The UNBLOCK operation returns the entire MJU tree to normal operation, except for any other blocked branches.

  RELEASE — returns the entire MJU tree to normal operation. A RELEASE operation may be performed after the branch has been SELECTed.

  WARNING: All BLOCKed branches are cleared by this operation.

  RESTORE — returns the MJU tree to normal operation. A RESTORE operation may be performed after the branch has been SELECTed. This command does not affect BLOCKed branches.

Figure 26 illustrates a T-BERD 224 testing the controls of a cascaded MJU. The figures accompanying the auxiliary function operations show the location in the network when the operation is complete.

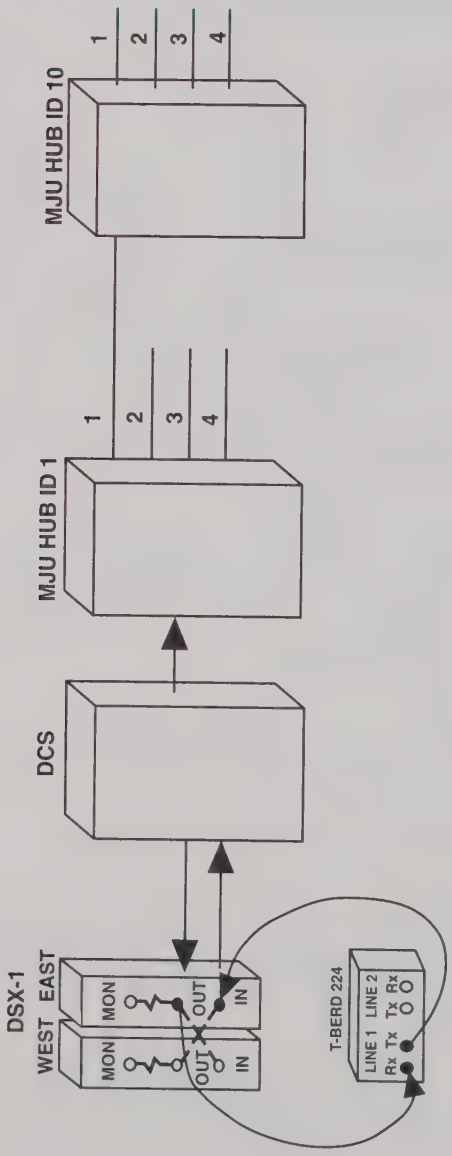


Figure 26
Cascaded MJU

1. **T1 circuit connections — See *Drop and Insert Test Setup/ Termination Test Setup - Recovered Timing***

2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to the appropriate DS0A or DS0B data rate.

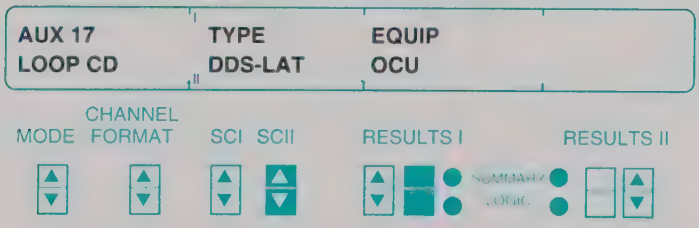
4. **SCI switch**
   Set to any BERT pattern. The test pattern is transmitted on the primary channel.

5. **SCII switch**
   If DS0B — Set subrate data channel.

6. **LINE 1 & 2 CHANNEL switches**
   Set to the channel under test.

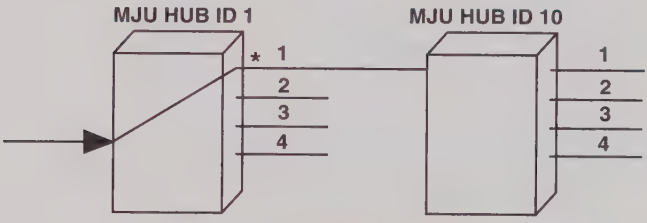
7. **AUX switch**
   Press to access auxiliary functions (LED ON).

8. **Select AUX 17 LOOP CD**
   Configure as shown to loop an OCU-DP.



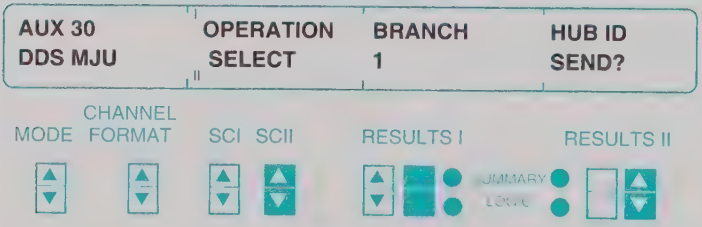
9. **Select AUX 30 MJU.**

10. **SELECT BRANCH 1.**

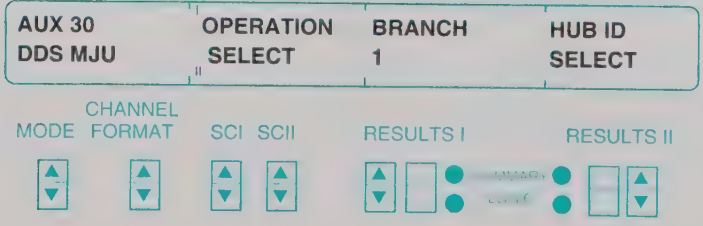


*LOCATION IN NETWORK

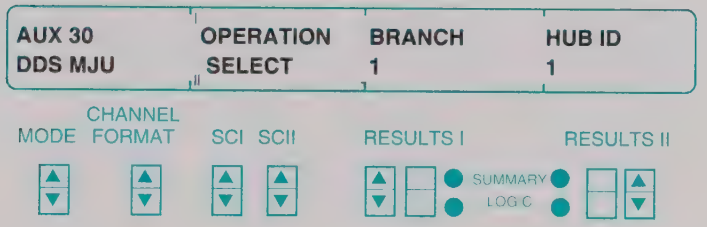
Press the **SCII** switch to choose the SELECT operation. Press the **RESULTS I Category** switch to select BRANCH 1. Press the **RESULTS II Results** switch to execute the command.



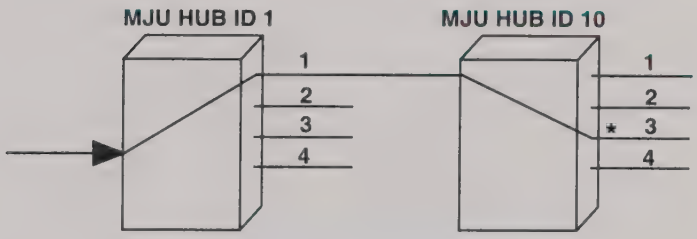
While sending the command the display appears as shown.



When the operation is complete the MJU responds with the HUB ID.

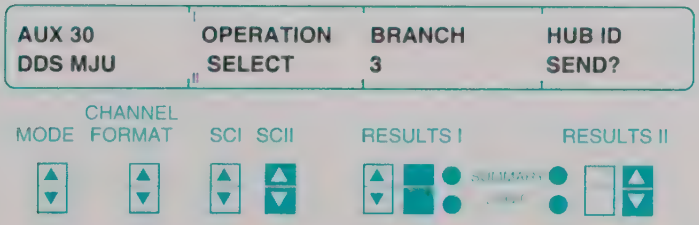


11. SELECT BRANCH 3

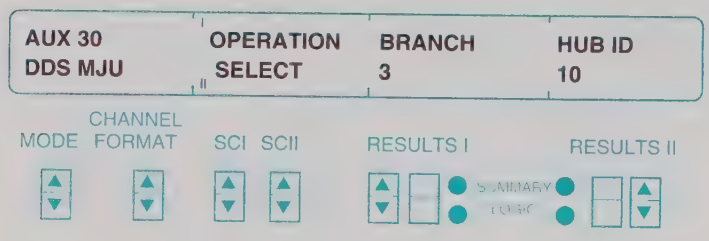


*LOCATION IN NETWORK

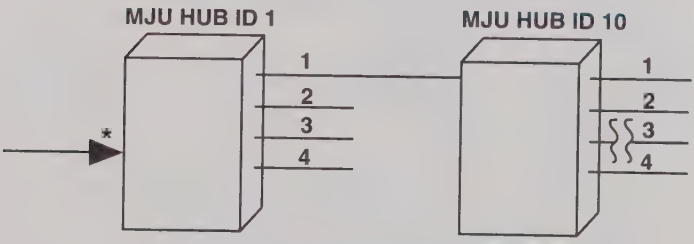
Press the **SCII** switch to choose the SELECT OPERATION.
Press the **RESULTS I Category** switch to select BRANCH 3.
Press **RESULTS II Results** switch to execute the command.



When the operation is complete the MJU responds with the HUB ID.

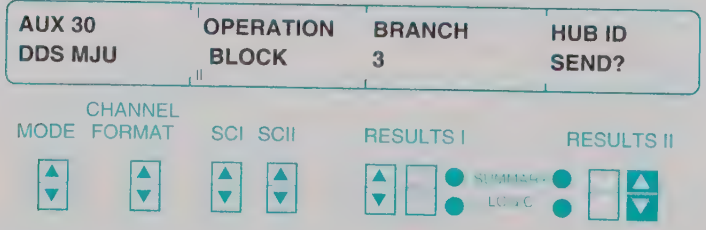


12. **BLOCK BRANCH 3**

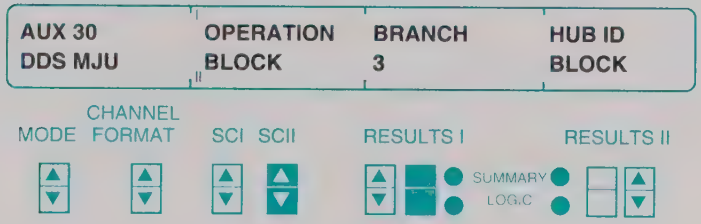


*LOCATION IN NETWORK

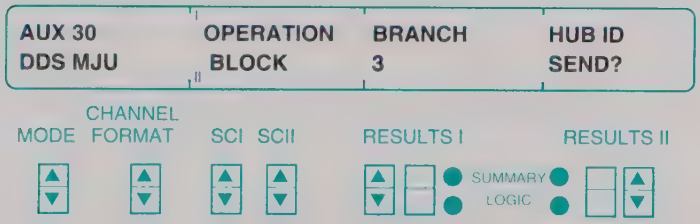
Press the **SCII** switch to choose the BLOCK OPERATION. Press the **RESULTS II Results** switch to execute the command.



While sending the command the display appears as shown.

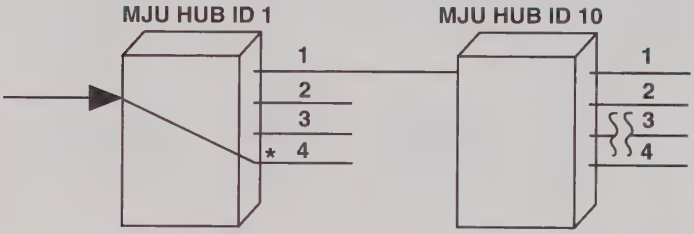


When the operation is successful the display appears as shown.



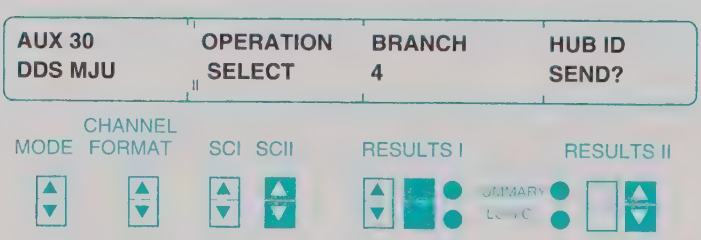
NOTE: To unblock this branch perform the same procedure using UNBLOCK instead of BLOCK.

13. SELECT BRANCH 4

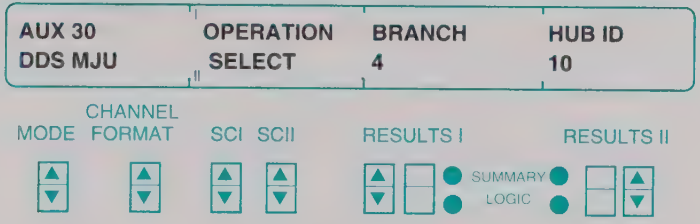


*LOCATION IN NETWORK

Press the **SCII** switch to choose the SELECT OPERATION.
Press the **RESULTS I Category** switch to select BRANCH 4.
Press the **RESULTS II Results** switch to execute the command.



Upon completion of the command, the MJU responds with the HUB ID and the display appears as shown.



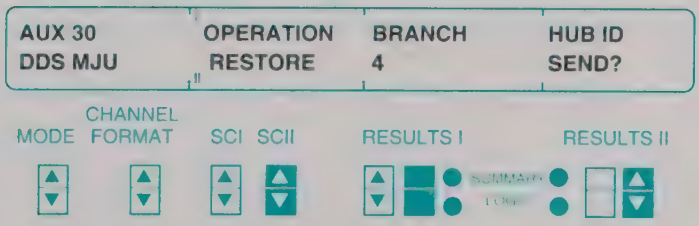
14. **AUX switch**
    Press to exit auxiliary functions (LED OFF).

15. **Go to *DDS Loopback Test***
    Perform a loopback and BERT test on the selected branch.

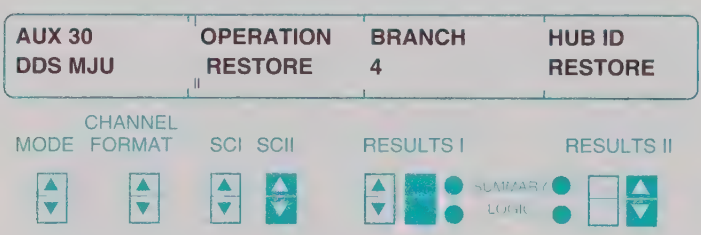
16. **AUX switch**
    Press to access auxiliary functions (LED ON).

    Select AUX 30 MJU.

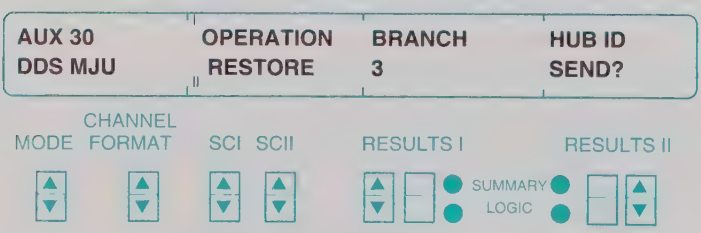
17. **RESTORE MJU**
    Restore the previously selected branch to normal operation. Press the **SCII** switch to choose the RESTORE OPERATION. Press the **RESULTS II Results** switch to execute the command.



While sending the command the displays appears as shown.



When the RESTORE operation is complete the display appears as shown.



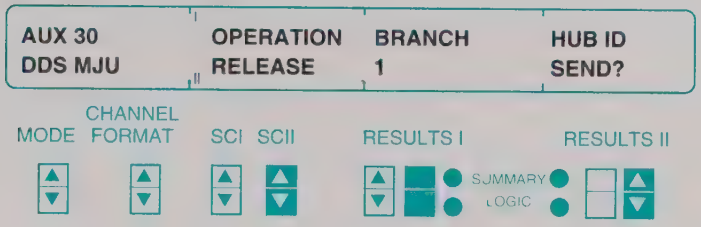
NOTE: The previously blocked branch is still blocked.

18. RELEASE MJU

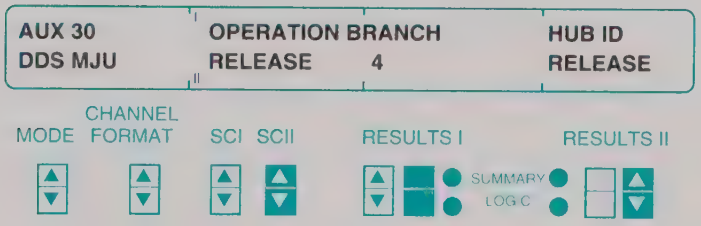
Clear entire MJU network. This command returns the MJU network to it's initial state.

WARNING: The RELEASE command clears the entire network including previously blocked branches.

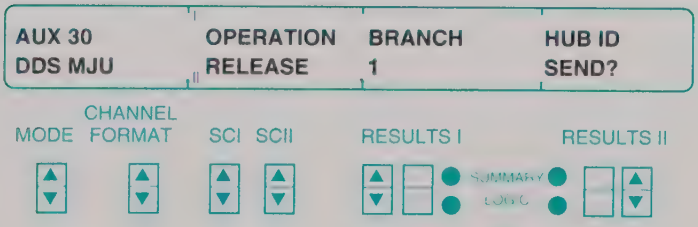
Press the **SCII** switch to choose the RELEASE operation. Press the **RESULTS I Category** switch to select BRANCH 1. Press the **RESULTS II Results** switch to send the RELEASE command.



While sending the command the displays appears as shown.



When the RESTORE operation is complete the display appears as shown.



19. **AUX switch**
Press to exit auxiliary functions (LED OFF).

VF TESTING

Observing 24 Channel's Signaling Bits

Monitoring a Voice Call

Voice-Grade Noise Testing

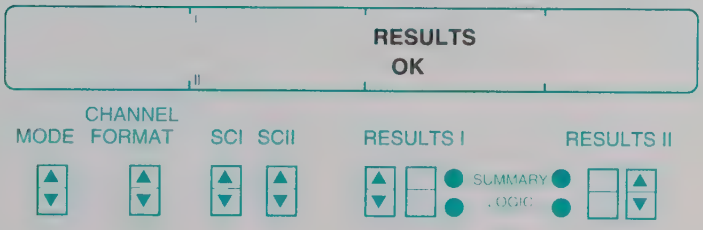
Data-Grade Noise Testing

27. Observing 24 Channel's Signaling Bits

- Locate the channels carrying traffic.
- Observe *handshaking* between communications equipment, such as switches and PBXs.
- Detect *stuck* or *hung* channels.

Figure 27 illustrates a T-BERD 224 monitoring a T1 circuit.

1. **T1 circuit connections — See *Monitor Test Setup***
2. **MODE switch**
   Set to AUTO.
3. **CHANNEL FORMAT switch**
   Set to VF.
4. **RESTART switch**
   Press to begin the test.
5. **LOCAL STATUS LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.
6. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.



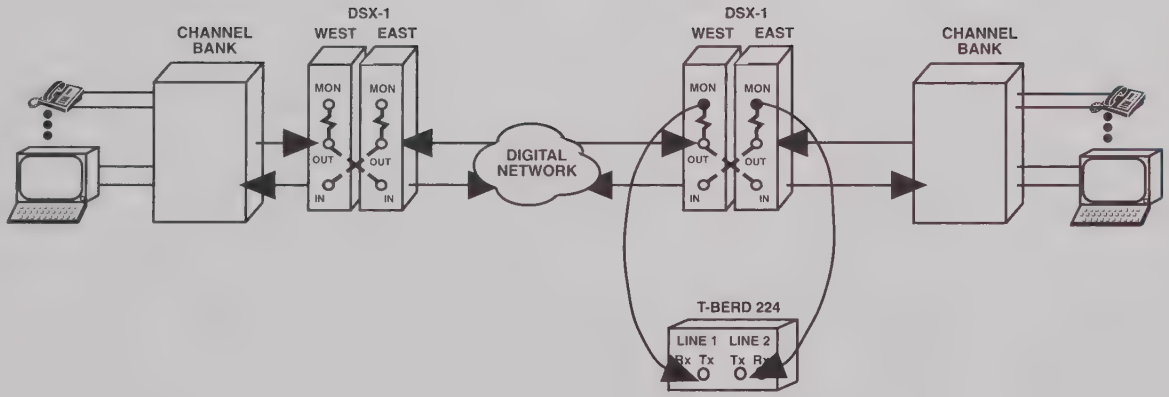
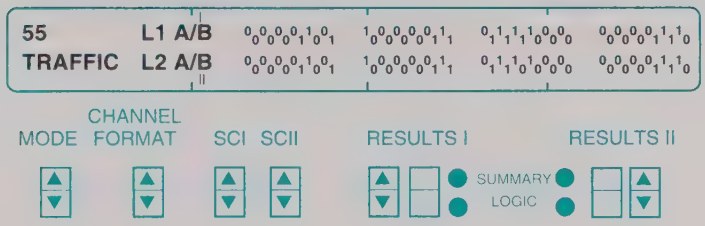


Figure 27
Observing 24 Channel's Signaling Bits

7. RESULTS II switches

Select the SIGNAL Category. Check the following result to look for activity on your T1 line.



8. Results interpretation

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

FRM ERRORS, CRC ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further upstream.

A and B signaling bits

The ON HOOK, OFF HOOK, and RINGING states of each of the channels is represented by the A and B signaling bits. Use the A and B signaling bits to identify whether the channel is active, idle, or stuck. See the Appendix Section of the *T-BERD 224 Reference Manual* for the individual bit patterns for the different trunk types.

28. Monitoring A Voice Call

- Verify continuity during circuit installations.
- Check Voice Frequency (VF) signal levels audibly and visually to confirm reported fault conditions.
- Determine the location of error sources.
- Measure the level of the signal.

Figure 28 illustrates a T-BERD 224 monitoring a T1 circuit.

1. **T1 circuit connections — See *Monitor Test Setup***

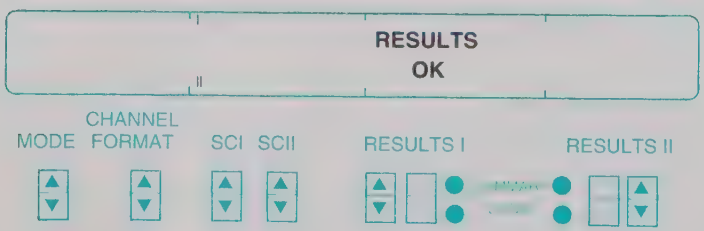
2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to VF.

4. **RESTART switch**
   Press to begin the test.

5. **LOCAL STATUS LEDs**
   Verify that the green signal and Frame Sync LEDs are illuminated.

6. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.



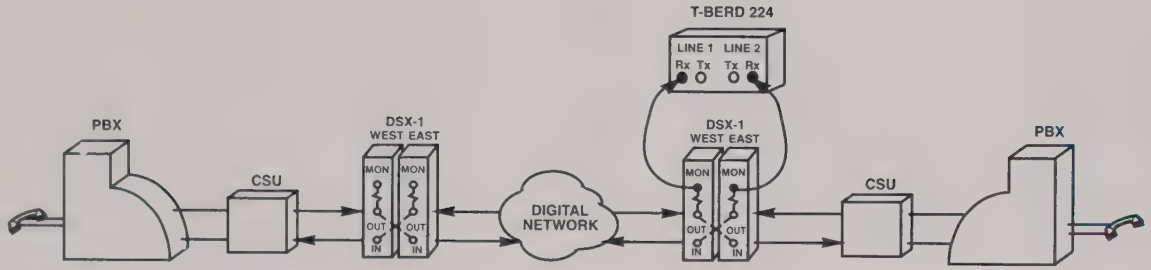


Figure 28
Monitoring a Voice Call

7. **CHANNEL switch**
   Set to selected channel numbers.

8. **Volume**
   Listen to each transmission direction and compare sound quality and level. The transmission direction of the fault may be determined.

9. **DROP switch**
   Set to monitor LINE 1, LINE 2, and then BOTH to sectionalize the fault to a transmission direction.

10. **Results interpretation**

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

FRM ERRORS, CRC ERRORS, No BPVs

Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further upstream.

Audible Faults

If the volume output of one transmission direction is significantly lower than the other direction, or audible "pops" or "crackles" are received from one transmission direction, then move the test set toward the origin of the faulty transmission direction to isolate the fault source.

RX LVL

The received level should be -20 dB +/- 3 dB at resistor isolated DSX-MON jacks. Incorrect levels could be caused by a facility T1 line card or poor cabling between the DSX jack and the equipment.

29. Voice-Grade Noise Testing
VF Option Required

- Measures noise levels for voice-grade lines carrying conversations (C-Message filters).
- Test for C-Notch noise, C-Message noise, Signal to Noise Ratio.
- Send and measure level of 404, 1004, and 2804 Hz tones.

Figure 29 illustrates the T-BERD 224 performing an end-to-end test in conjunction with a VF test set located at the end of a VF local loop.

NOTE: The sequence of transmitting and measuring specific tones and results must be performed at the remote test set simultaneously for proper circuit analysis.

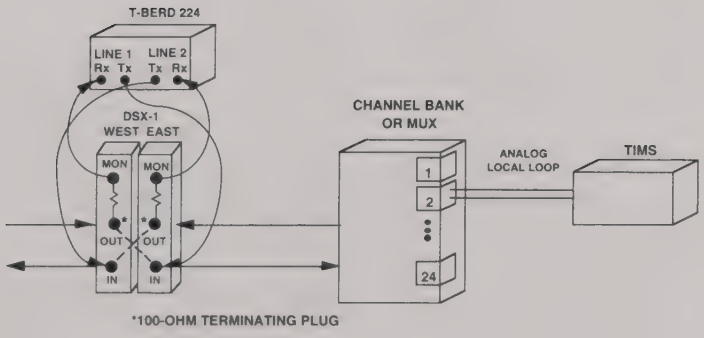


Figure 29
Measuring Voice-Grade Noise

1. **T1 circuit connections — See *Drop and Insert Test Setup/TAD Test Setup***

2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to VF.

4. **Volume**
   Set to mid range.

5. **LINE 1 & 2 CHANNEL switch**
   Set to the channel carrying the voice traffic.

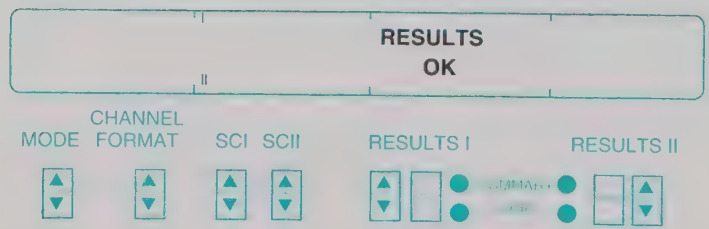
6. **INSERT switch**
   Set LINE 1.

7. **DROP switch**
   Set to LINE 2.

8. **RESTART switch**
   Press to restart test and clear all results.

9. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

10. **RESULTS I switches**
    Select the SUMMARY Category. Verify results are *OK*.

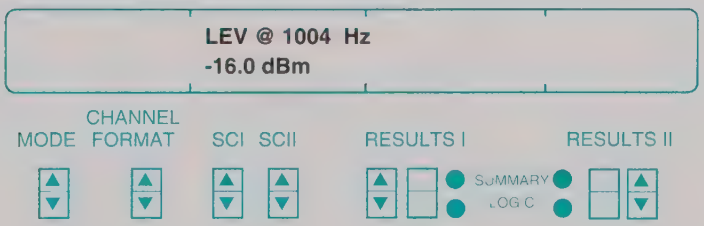


Measuring Level, Frequency, C-Notch Noise, and S/N Ratio

This procedure assumes that a 1004 Hz, -16 dBm test tone is transmitted toward the T-BERD 224 from the remote VF test set.

1. **SCI switch**
   Set to LEVEL.

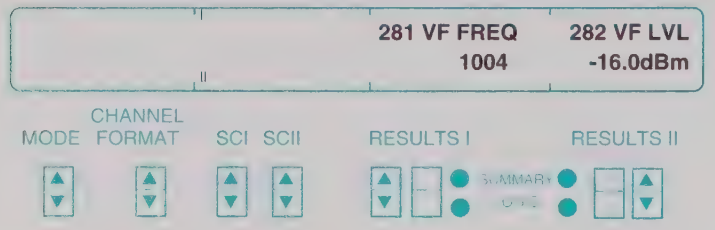
2. **SCII switch**
   Set to appropriate transmit level.



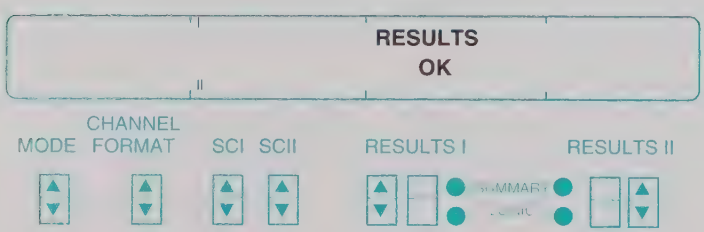
An idle code of all ones will be transmitted into the channel selected for LINE 1 to prevent loop and test tones from being transmitted throughout the rest of the circuit.

3. **Volume**
   Verify continuity by listening to the 1004 Hz test tone.

4. **RESULTS switches**
   Select the CHANNEL Category. Check the following results. Record the value for VF LVL. See **Results interpretation** for more information.



5. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.

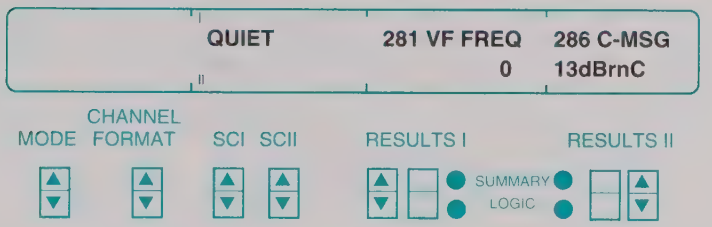


Measuring C-Message Noise

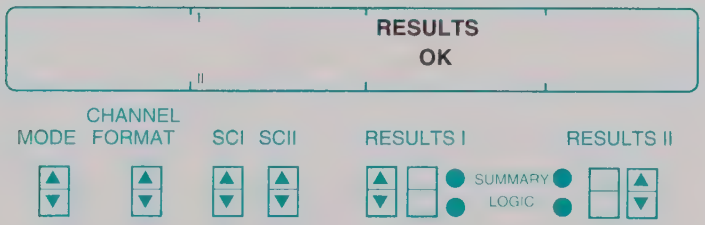
This procedure assumes that a quiet termination (i.e., a 400, 600, or 1200-ohm terminating resistance) is being provided by the remote VF test set.

1. **SCI switch**
   Set to QUIET.

2. **RESULTS switches**
   Select the CHANNEL Category. Check the following results. See **Results interpretation** for more information.



3. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.

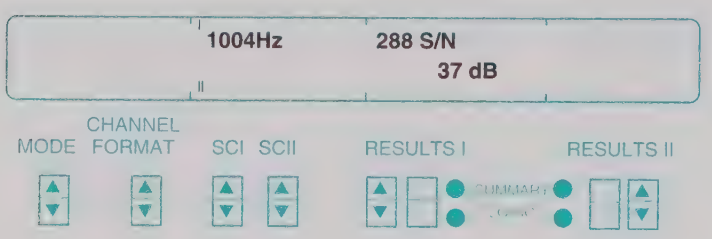


Measuring Signal to Noise

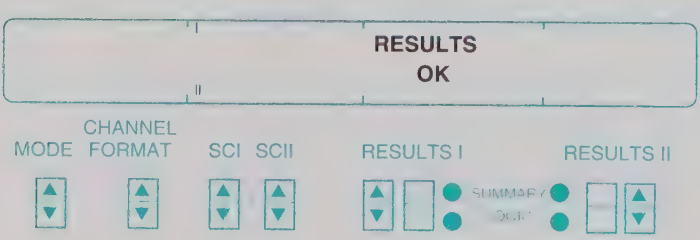
This procedure assumes that 1004 Hz test tone is transmitted toward the T-BERD 224 from the remote VF test set.

1. **SCI switch**
   Set to 1004Hz.

2. **RESULTS switches**
   Select the CHANNEL Category. Check the following results. See **Results interpretation** for more information.



3. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.

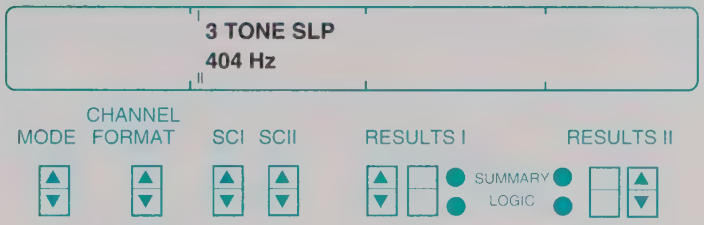


Measuring 3 Tone Slope

This procedure assumes that a 404 Hz, 1004 Hz, and 2804 Hz test tones are transmitted toward the T-BERD 224 from the remote VF test set.

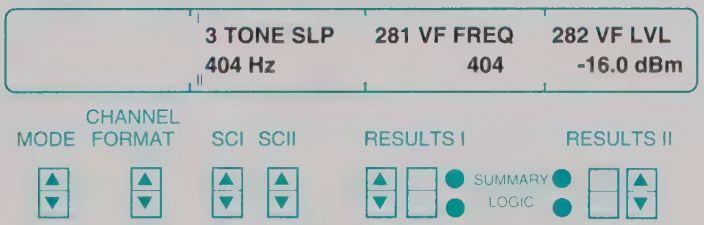
1. **SCI switch**
   Set to 3-TONE SLP.

2. **SCII switch**
   Set to 404 Hz.



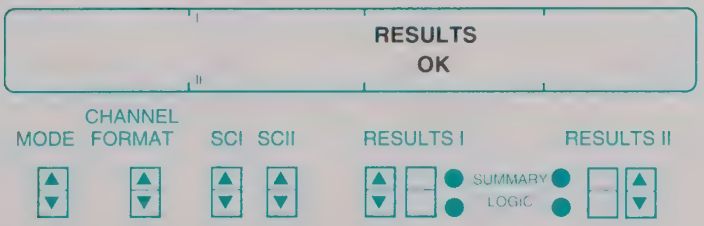
3. **RESULTS switches**

   Select the CHANNEL Category. Check the following results. Record the value for VF LVL. See **Results interpretation** for more information.

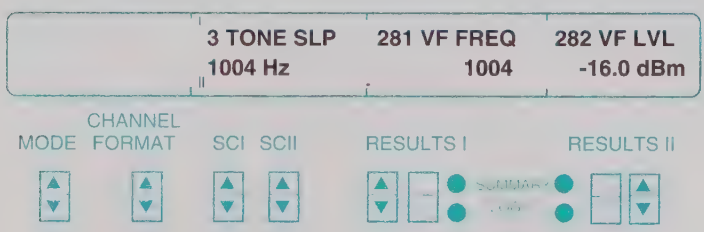


4. **RESULTS I switches**

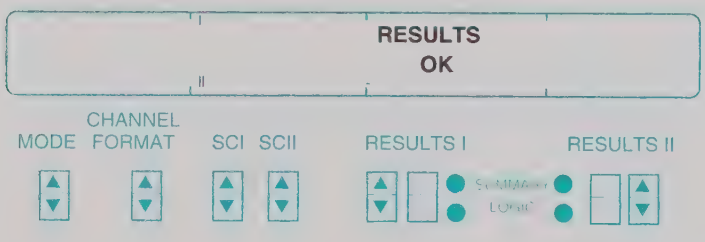
   Select the SUMMARY Category. Verify results are *OK*.



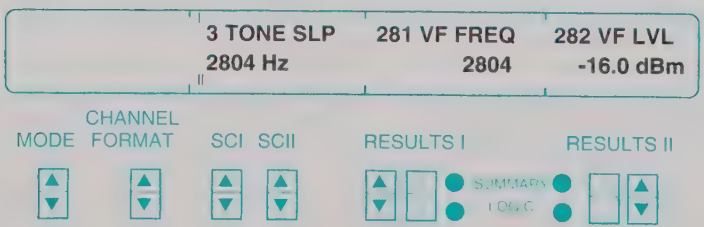
5. **SCII switch**
   Set to 1004 Hz. Record the value for VF LVL.



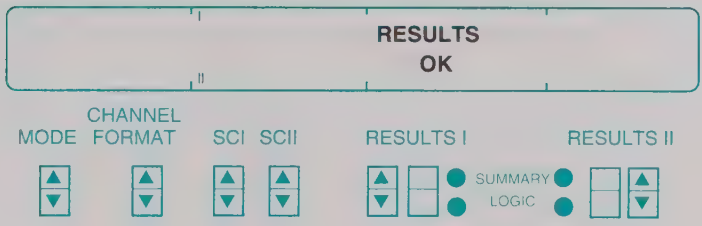
6. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.



7. **SCII switch**
   Set to 2804 Hz. Record the value for VF LVL. See **Results interpretation** for more information.



8. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.



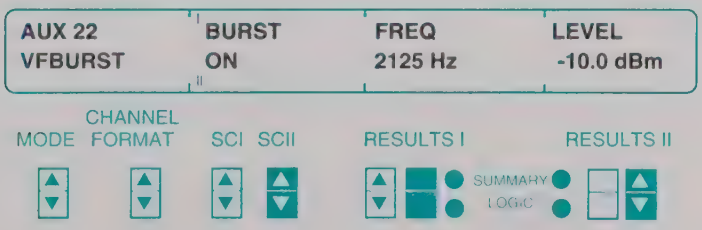
Measuring Return Loss

This procedure assumes that a quiet termination (i,e. a 400, 600, or 1200-ohm terminating resistance) is being provided by the remote VF test set.

1. **SCI switch**
   Set to ERL.

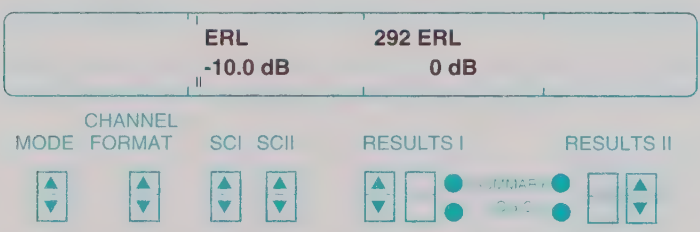
2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   AUX 22 VF BURST is displayed automatically. Configure as shown.



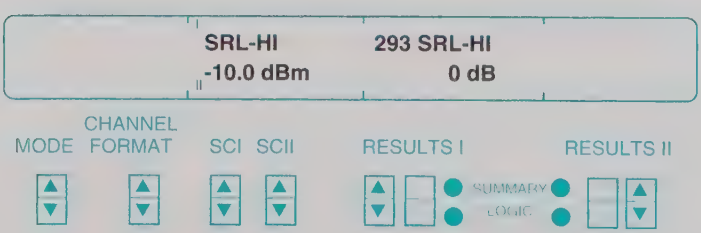
3. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

4. **RESULTS switches**
   Select the CHANNEL Category. Check the following results.
   See **Results interpretation** for more information.



5. **SCI switch**
   Set to SRL-HI.

6. **RESULTS switches**
   Select the CHANNEL Category. Check the following results.
   See **Results interpretation** for more information.



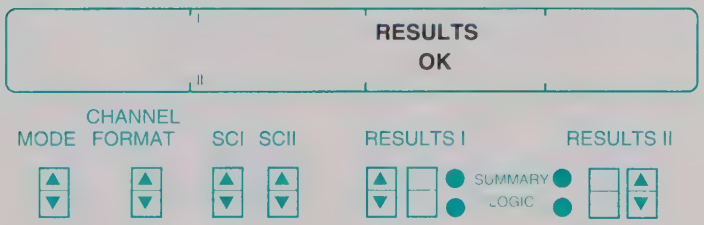
7. **SCI switch**
   Set to SRL-LO.

8. RESULTS switches

Select the CHANNEL Category. Check the following results. See **Results interpretation** for more information.

9. RESULTS I switches

Select the SUMMARY Category. Verify results are *OK*.



Results interpretation

BPVs, FRM ERR, CRC ERR

Local T1 problem. Possibly faulty T1, audible noise, repeater, span line noise, crosstalk, poor line cabling, bad cabling between test set and circuit, corroded *dirty* cable plugs.

FRM ERR, CRC ERR

Typically a far-end T1 span problem. Sectionalize further. Check cross-connect switches, multiplexers, and repeaters, as well as the cabling between these devices.

VF LVL out-of-spec, SUMMARY RESULTS OK
VF circuit problem. Check level and LBO settings on modems, line repeaters, channel bank plug-ins, and multiplexer cards. Check VF local loop for shorts, opens, grounds, etc.

ERL, SRL-HI, SRL-LO out-of-spec, SUMMARY RESULTS OK
2-wire/4-wire hybrid converter impedance mismatch. Check impedance settings.

Audible Distortion, SUMMARY RESULTS OK
VF circuit problem — attenuation distortion. Check VF line repeaters, and line cards containing digital/analog converters. May require reconditioning analog local loop (remove load coils etc.).

C-MSG out-of-spec, SUMMARY RESULTS OK
VF circuit problem. Crosstalk from adjacent cable pairs, 60 Hz induction from power lines, possible VF local loop problems (one side open, unbalanced line).

C-NOTCH, S/N, SUMMARY RESULTS OK
VF circuit problem. Bad line card in channel bank, multiplexer, or SLC terminal, bad VF repeater, 1004 Hz tone out-of-range.

30. Data-Grade Noise Testing
VF Option Required

- Test for 3 kHz Flat Noise, P/AR, Sweep, and Signal to Noise Ratio.
- Provides an overall indication of a voice-grade circuit's ability to carry high speed data.
- Obtain a quick indication of a channels amplitude distortion.
- Test beyond the minimum requirements of voice-grade service.
- Measures the *smearing* of a data signal over an analog loop and indicates the likelihood of intersymbol interference (BIT ERRORS).

Figure 30 illustrates the T-BERD 224 performing an end-to-end test in conjunction with a VF test set located at the end of a VF local loop.

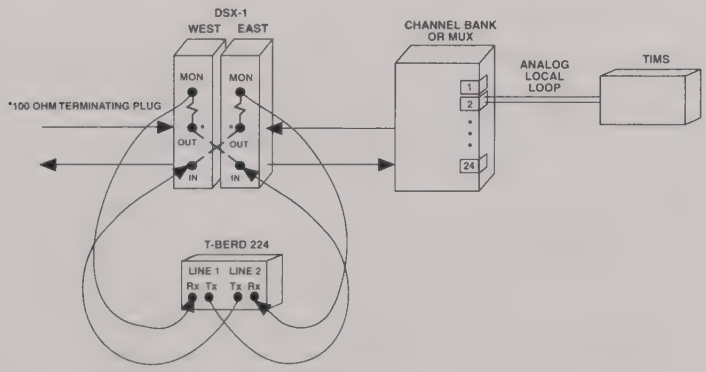


Figure 30
Measuring Noise

NOTE: The sequence of transmitting and measuring specific tones and results must be performed at the remote test set simultaneously for proper circuit analysis.

1. **T1 circuit connections — See *Drop and Insert Test Setup/TAD Test Setup***

2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to VF.

4. **Volume**
   Set to mid range.

5. **LINE 1 & 2 CHANNEL switch**
   Set to the channel carrying the voice traffic.

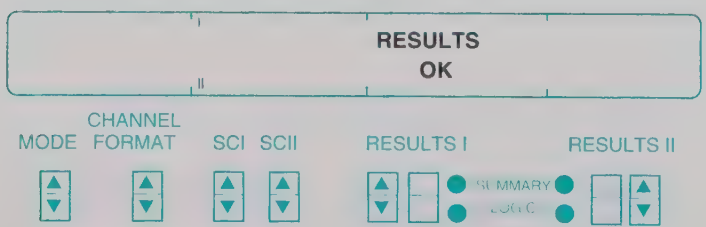
6. **INSERT switch**
   Set LINE 1.

7. **DROP switch**
   Set to LINE 2.

8. **RESTART switch**
   Press to restart test and clear all results.

9. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

10. **RESULTS I switches**
    Select the SUMMARY Category. Verify results are *OK*.

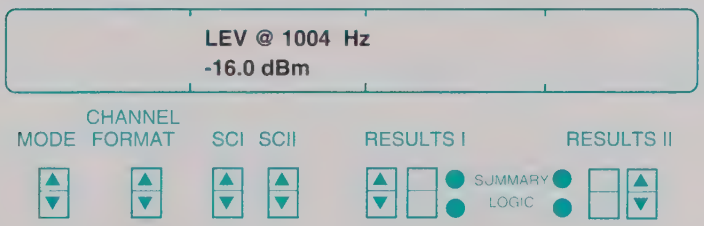


Measuring 3kHz Notch Noise

This procedure assumes that a 1004 Hz, -16dBm test tone is transmitted toward the T-BERD 224 from the remote VF test set.

1. **SCI switch**
   Set to LEVEL.

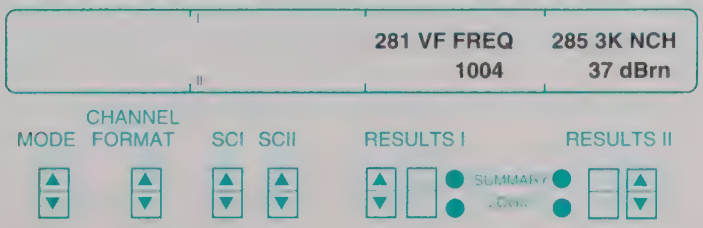
2. **SCII switch**
   Set to appropriate transmit level.



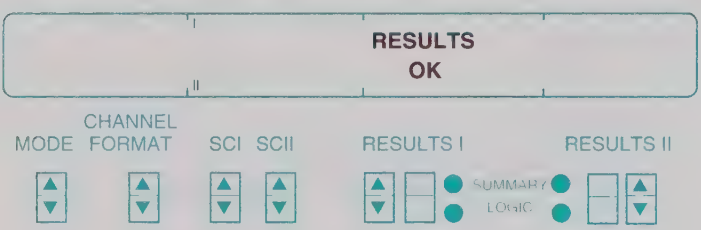
An idle code of all ones will be transmitted into the channel selected for LINE 1 to prevent loop and test tones from being transmitted throughout the rest of the circuit.

3. **Volume**
   Verify continuity by listening to the 1004 Hz test tone.

4. **RESULTS switches**
   Select the CHANNEL Category. Check the following results. Record the value for VF LVL.



5. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.

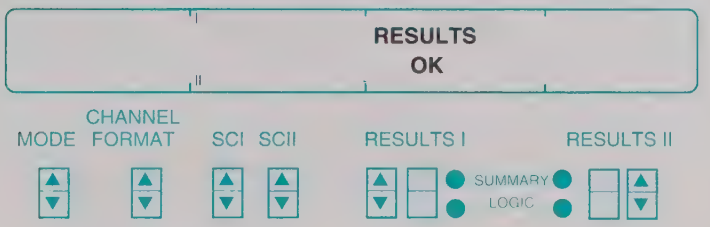


Measuring 3kHz Flat Noise

1. **SCI switch**
   Set to QUIET.

2. **RESULTS switches**
   Select the CHANNEL Category. Check the following results. Record the value for 3KFLAT.

3. **RESULTS I switches**
   Press the **SCI** switch to display the step in the second window. Select the SUMMARY Category. Verify results are *OK*.



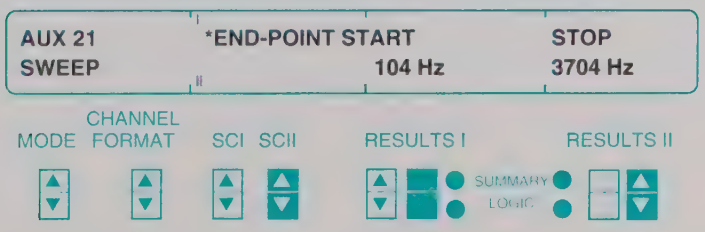
Frequency Sweep vs. Level Analysis (Channel Transfer Function)

1. **SCI switch**
   Set to SWEEP.

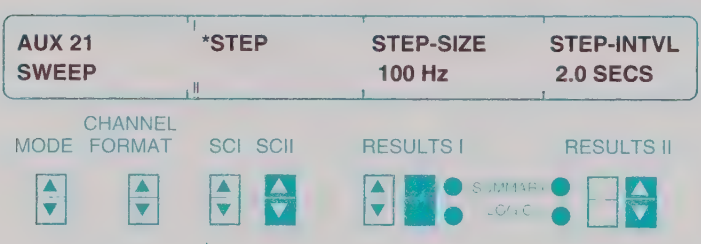
2. **AUX switch**
   Press to access auxiliary functions (LED ON).

   AUX 21 SWEEP is displayed automatically.

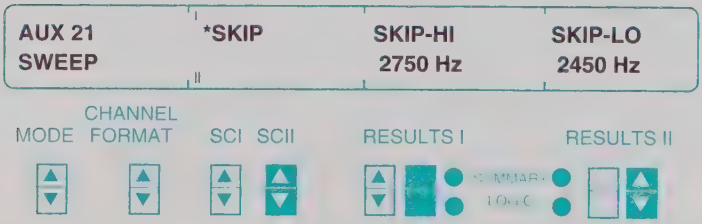
   Press the **RESULTS I Category** switch to set the START point for the sweep. Press the **RESULTS II Results** switch to set the STOP end-point for the sweep.



Press the **RESULTS I Category** switch to set the STEP-SIZE of the incremental frequency. Press the **RESULTS II Results** switch to set STEP-INTVL for the incremental frequency.

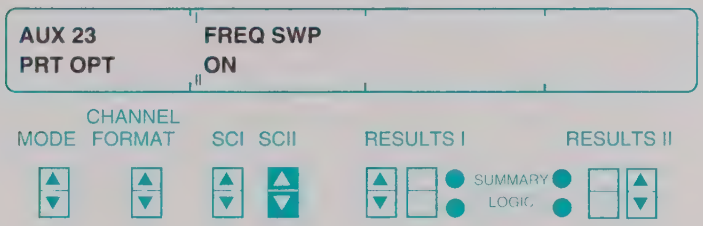


Press the **SCII** switch to display the step in the second window. Press the **RESULTS I Category** switch to set the high end of the skipped frequency bandwidth. Press the **RESULTS II Results** switch to set the low end of the skipped frequency bandwidth.



NOTE: The T-BERD 224 automatically performs a validation check of the entered values. If the parameters are inconsistent, an error message will flash for two seconds, the frequency sweep setup operation is aborted, and the original settings remain.

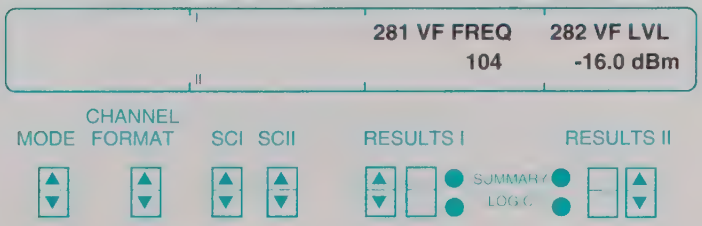
Select AUX 23 PRT OPT.



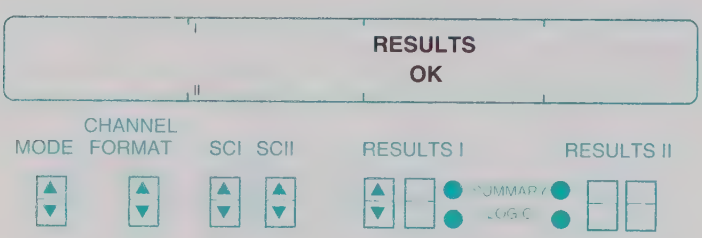
3. **AUX switch**
   Press to exit the auxiliary functions (LED OFF).

4. **SCII switch**
   Set to appropriate transmit level.

5. **RESULTS switches**
   Select the CHANNEL Category. Check the following results.



6. **RESULTS I switches**
   Select the SUMMARY Category. Verify results are *OK*.



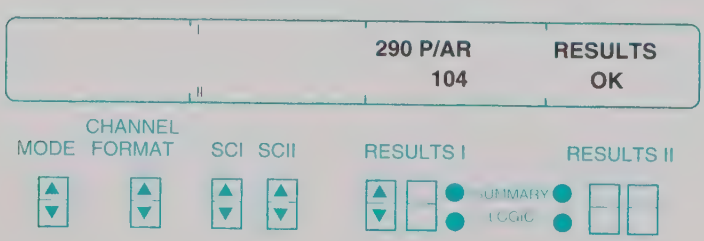
Measuring P/AR

Although it is possible to perform a P/AR test with a remote loopback, it is not recommended because impairments on the return path may "correct" the results which indicate faults on the transmit path.

1. **SCI switch**
   Set to PAR.

2. **SCII switch**
   Set to level of the transmit P/AR spectrum.

3. **RESULTS switches**
   Select the CHANNEL and SUMMARY Category. Check the following results. Verify results are *OK*.



Results interpretation

FRM ERR, CRC ERR, BPVs
Local T1 problem. Possibly faulty T1, audible noise, repeater, span line noise, crosstalk, poor line cabling, bad cabling between test set and circuit, corroded "dirty" cable plugs.

FRM ERR, CRC ERR, No BPVs
Typically a far-end T1 span problem. Sectionalize further. Check cross-connect switches, multiplexers, and repeaters, as well as the cabling between these devices.

Gain vs. Frequency Curve out-of-spec, SUMMARY RESULTS OK
Possible VF circuit problem. Check local span for sources of attenuation distortion such as bridge taps, companders, and equalizers.

3K FLAT out-of-spec, SUMMARY RESULTS OK
VF circuit problem. Check for crosstalk from adjacent circuits, 60 Hz induction from power lines, possible VF local loop problem (one side open, unbalanced lines, etc.).

3K NCH out-of-spec, SUMMARY RESULTS OK
VF circuit problem. Bad line card in channel bank, multiplexer, or SLC terminal. Bad VF repeater, 1004 Hz tone out-of-range.

P/AR out-of-spec, SUMMARY RESULTS OK
Poor return loss, attenuation distortion, or envelope delay distortion. Separately perform return loss, frequency sweep, and EDD test.

NOTE: External TIMS set required for EDD test.

31. Establishing an 829 Termination Loopback *VF Option Required*

- Establish a remote loopback by sending a 2713 Hz tone toward the 829 termination,

Figure 31 illustrates the T-BERD 224 establishing a remote loopback.

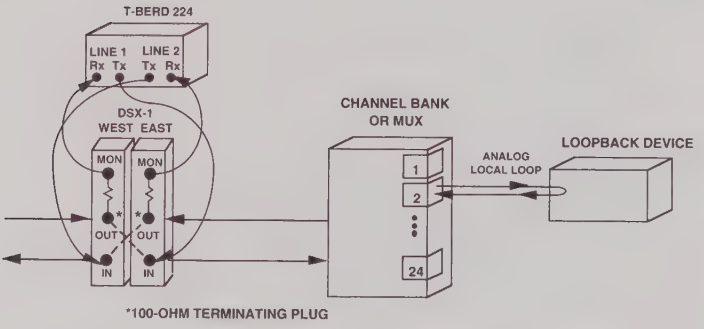


Figure 31
Loopback Testing

1. **T1 circuit connections — See *Drop and Insert Test Setup/TAD Test Setup***

2. **MODE switch**
   Set to AUTO.

3. **CHANNEL FORMAT switch**
   Set to VF.

4. **Volume**
   Set to mid range.

5. **LINE 1 & 2 CHANNEL switch**
   Set to the channel carrying the voice traffic.

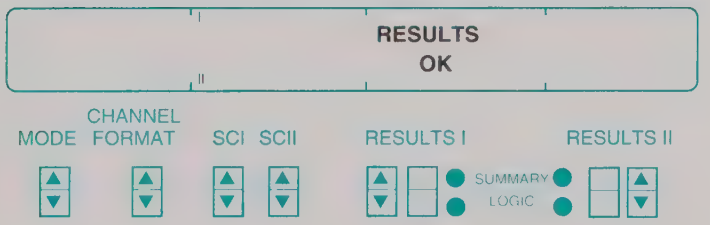
6. **INSERT switch**
   Set LINE 1.

7. **DROP switch**
   Set to LINE 2.

8. **RESTART switch**
   Press to restart test and clear all results.

9. **Local Status LEDs**
   Verify that the green Signal and Frame Sync LEDs are illuminated.

10. **RESULTS I switches**
    Select the SUMMARY Category. Verify results are *OK*.



11. **SCI switch**
    Set to 2713.

12. **SCII switch**
    Set to ON.

13. **Volume**
    Verify the loopback by listening to the 2713 Hz test tone.

14. **SCII switch**
    Set to OFF.
    The far-end is now looped, enabling single-ended testing of the VF circuit.

15. **SCII switch — Remove loopback**
    Set to ON.

16. **Volume**
    The 2713 Hz tone is no longer heard when the loopback is removed.

17. **SCII switch**
    Set to OFF.

SIGNALING TESTING

Originate a Call

Terminate a Call

Originate an Incoming Call

Monitor Switch to Switch

Scan T1 for Active Channels

Switch 56 Testing

32. Originate A Call
Signaling Option Required

- Test the switches ability to handle incoming calls.
- Test whether the switch is configured and operating correctly.
- The T-BERD 224 emulates a PBX or an originating switch.

Figure 32 illustrates a T-BERD 224 originating a call.

1. **T1 circuit connections — See *Terminate Test Setup - Recovered Timing***

2. **MODE switch**
   Set according to network.

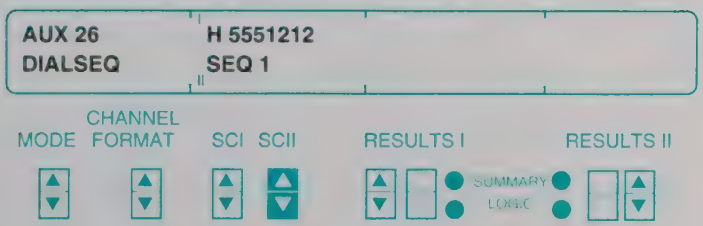
3. **CHANNEL FORMAT switch**
   Set to SIGNLNG.

4. **SCI switch**
   Set to DIAL SEQ.

5. **SCII switch**
   Set to SEQ 1.

6. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 26 DIAL SEQ. Configure as shown.



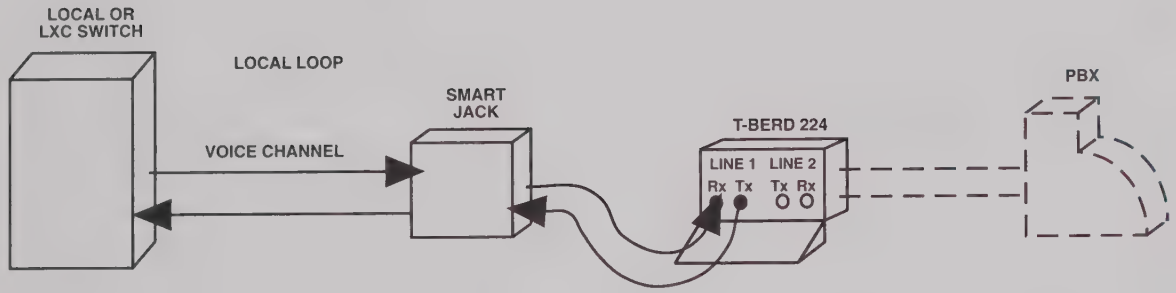
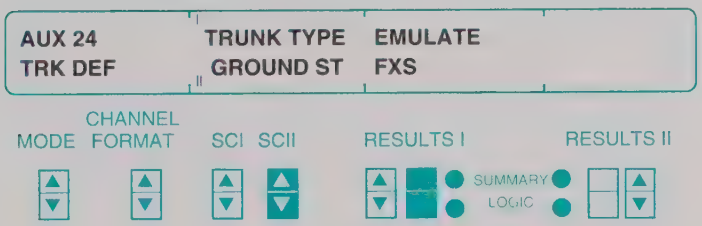


Figure 32
Originating A Call

SIGNALING KEYPAD LID
ORIG SUPV — Press OFF HOOK.
KEYPAD — Enter number to be dialed.
ENTER — Press to store sequence.

Select AUX 24 TRK DEF. Configure as shown to emulate an FXS circuit using ground start signaling.



7. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

8. **DROP switch**
   Set to LINE 1.

9. **INSERT switch**
   Set to LINE 1.

10. **LINE 1 & 2 CHANNEL switches**
    Set to channel (1 to 24) under test.

11. **RESULTS switches**
    Select the CHANNEL category. Scroll to result 1100 DELAY.

12. **RESTART switch**
    Press to begin the test and clear results. Verify DIAL SEQ appears in display.

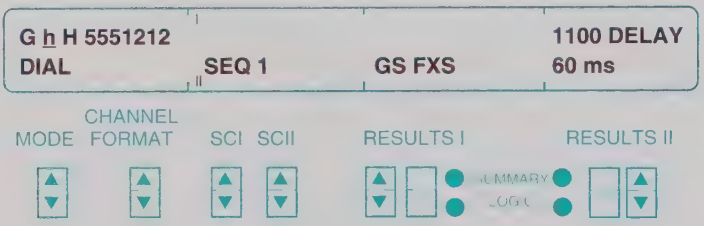
13. **Local Status LEDs**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

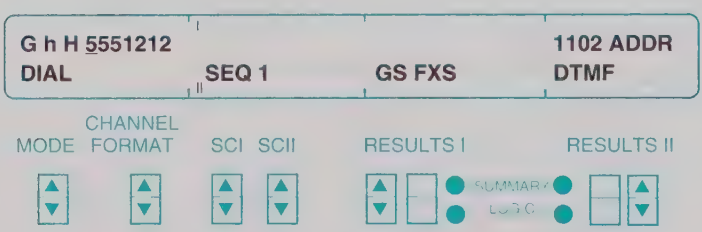
14. **Result verification**

Verify the following results.

SIGNALING KEYPAD LID

Use the CURSOR, and right and left ARROW keys to place the cursor under events or digits.





15. **Results interpretation**

If ring back tone and answer tone will be heard at the T-BERD 224 speaker then the dialing is successful. When far end answers the call, a talk path is established. Use a butt set to communicate with the far end.

Wink delay and duration — switch wink timing parameters need adjustment.

Incorrect digits being sent — potential switch translation problem.

Incorrect number of digits — potential switch translation problem.

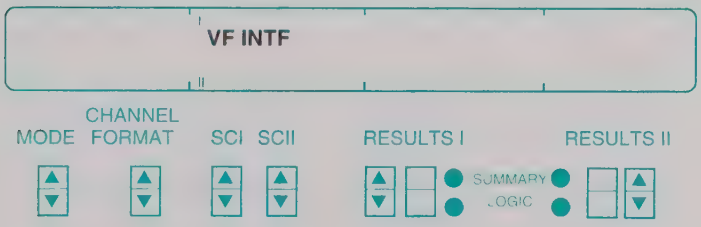
On hook during conversation — potential switch line/trunk card problem.

Incorrect digit frequency or level — potential switch line card problem.

NOTE: To measure delay, duration, level, and frequency on digits requires the Digit Analysis Option.

16. SCI switch - optional testing

Set to a standard VF test.



17. Disconnect call

SIGNALING KEYPAD LID

ORIG SUPV — Press ON HOOK.

The call is disconnected when the far end hangs up.

33. Terminate A Call
Signaling Option Required

- Test the ability of a PBX or a switch to originate a call.
- Test whether a PBX or an originating switch are configured and operating correctly.
- T-BERD 224 emulates a terminating switch.

Figure 33 illustrates a T-BERD 224 terminating a call.

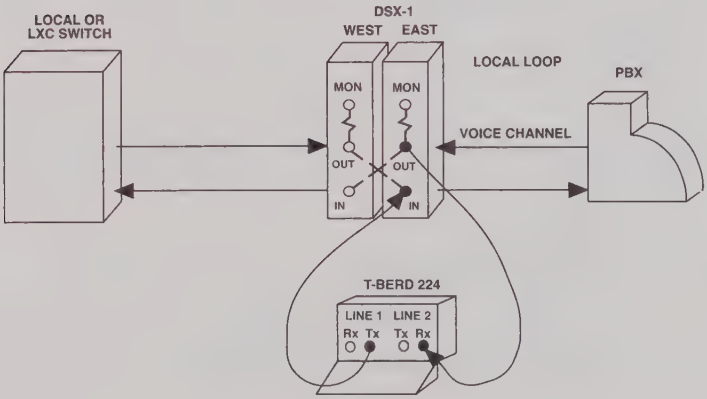


Figure 33
Terminating A Call

1. **T1 circuit connections — See *Terminate Test Setup - Internal Timing***

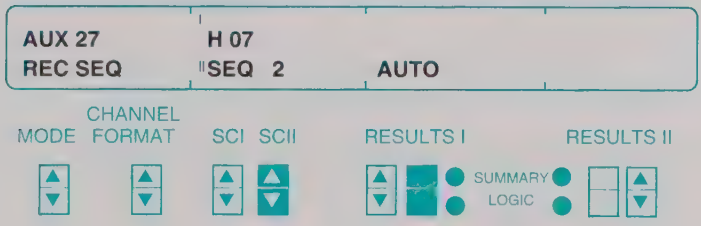
2. **MODE switch**
   Set according to network.

3. **CHANNEL FORMAT switch**
   Set to SIGNLNG.

4. **SCI switch**
   Set to REC SEQ.

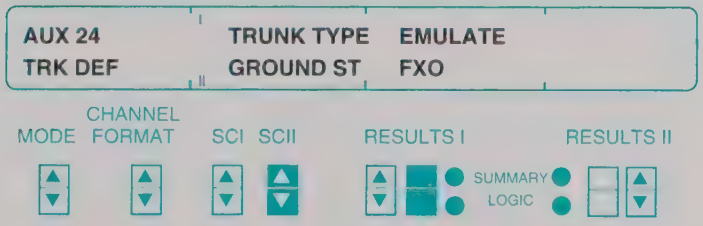
5. **SCII switch**
   Set to SEQ 2.

6. **AUX switch**
   Press to access auxiliary functions (LED ON).
   Select AUX 27 REC SEQ. Configure as shown.



SIGNALING KEYPAD LID
ORIG SUPV — Press OFF HOOK.
KEYPAD — Enter number of digits to be received.
ENTER — Press to store sequence.

Select AUX 24 TRK DEF. Configure as shown.



7. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

8. **DROP switch**
   Set to LINE 2.

9. **INSERT switch**
   Set to LINE 1.

10. **LINE 1 & 2 CHANNEL switches**
    Set to channel (1 to 24) under test.

11. **RESULTS switches**
    Select the CHANNEL category. Scroll to result 2100 DELAY.

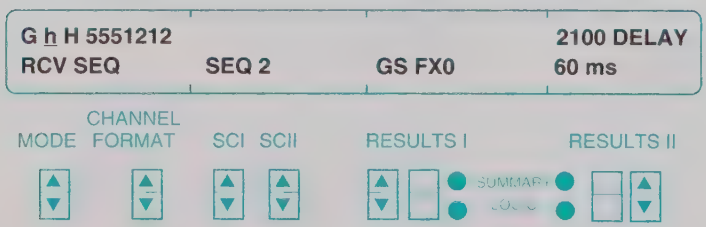
12. **RESTART switch**
    Press to begin the test and clear results. Verify RCV SEQ appears in display.

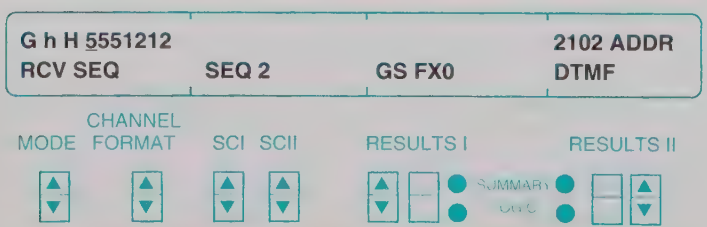
13. **Local Status LEDs**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

14. **T-BERD 224 is configured to capture a call originating from the PBX.**

15. **Results verification**
    Verify the following results.

    SIGNALING KEYPAD LID
    Use the right and left **ARROW** keys to place the cursor under events or digits.





16. **Butt set - optional**

The T-BERD224 provides a talk path through the 2-wire VF interface.

17. **Results interpretation**

T-BERD 224 receives digits from PBX and allows avaluation of digits. It also can identify address type to determine proper setup.

Wink delay and duration — switch wink timing parameters need adjustment.

Incorrect digits being sent — potential switch translation problem.

Incorrect number of digits — potential switch translation problem.

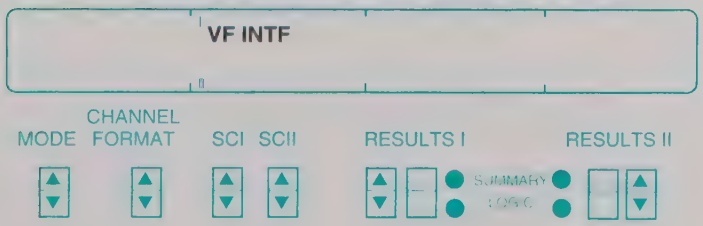
On hook during conversation — potential switch line/trunk card problem.

Incorrect digit frequency or level — potential switch line card problem.

NOTE: To measure delay, duration, level, and frequency on digits requires the Digit Analysis Option.

18. **SCI switch - optional testing**

Set to a standard VF test.



19. **Disconnect call**

SIGNALING KEYPAD LID

TERM SUPV — Press ON HOOK.

34. Originate An Incoming Call
Signaling Option Required

- Test the PBX's ability to handle incoming calls.
- The T-BERD 224 emulates a CO switch.

Figure 34 illustrates a T-BERD 224 originating a call.

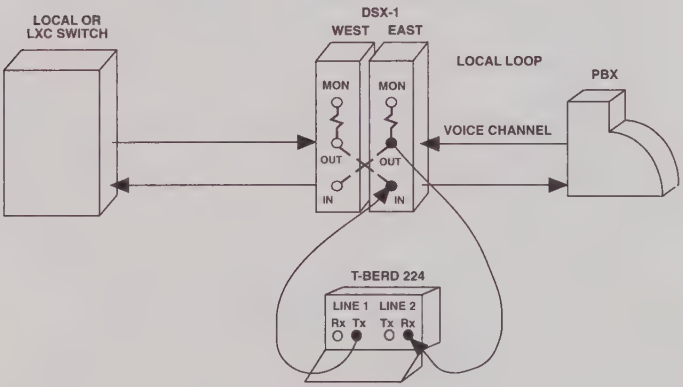


Figure 34
Originating An Incoming Call

1. **T1 circuit connections — See *Terminate Test Setup - Internal Timing***

2. **MODE switch**
   Set according to network.

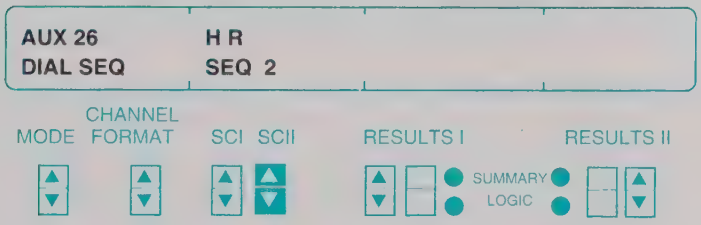
3. **CHANNEL FORMAT switch**
   Set to SIGNLNG.

4. **SCI switch**
   Set to DIAL SEQ.

5. **SCII switch**
   Set to SEQ 2.

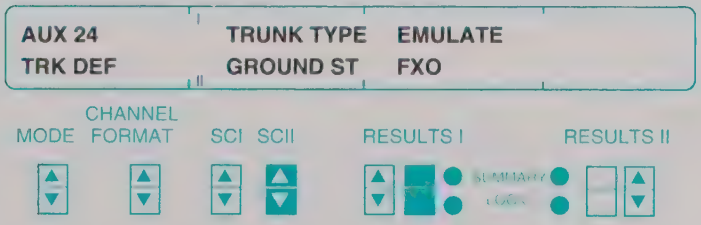
6. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 26 DIAL SEQ. Configure as shown.



SIGNALING KEYPAD LID
ORIG SUPV — Press **OFF HOOK**.
ORIG SUPV — Press **RING**.
ENTER — Press to store sequence.

Select AUX 24 TRK DEF. Configure as shown.



7. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

8. **DROP switch**
   Set to LINE 2.

9. **INSERT switch**
   Set to LINE 1.

10. **LINE 1 & 2 CHANNEL switches**
    Set to channel (1 to 24) under test.

11. **RESULTS switches**
    Select the CHANNEL category. Scroll to result 2100 DELAY.

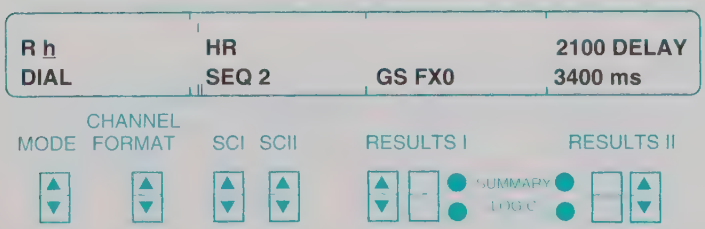
12. **RESTART switch**
    Press to begin the test and clear results. Verify DIAL SEQ appears in display.

    NOTE: The T-BERD 224 will send RINGING until the far end answers.

13. **Local Status LEDs**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

14. **Results verification**
    Verify the following results.

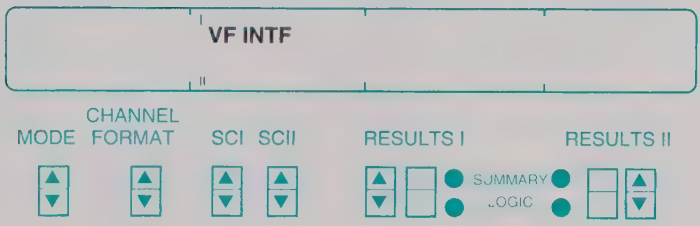
    SIGNALING KEYPAD LID
    Use the right and left **ARROW** keys to place the cursor under events or digits.



15. **Results interpretation**
When the connection is complte listen to other end to verify the operation of the PBX.

16. **Butt set - optional**
The T-BERD 224 provides a talk path through the 2-wire VF interface.

17. **SCI switch - optional testing**
Set to a standard VF test.



18. **Disconnect call**
SIGNALING KEYPAD LID
ORIG SUPV — Press **ON HOOK**.

35. Monitor Switch to Switch
Signaling Option Required

- Monitor supervisory events and digits to ensure proper communication between switches.

Figure 35 illustrates a T-BERD 224 monitoring switch to switch.

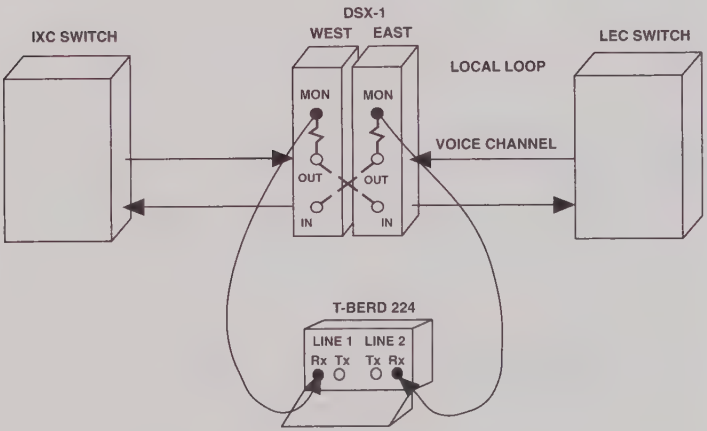


Figure 35
Monitor Switch to Switch

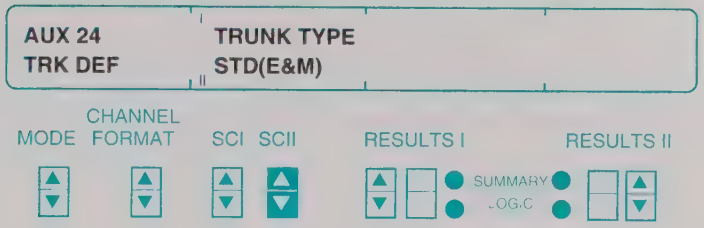
1. **T1 circuit connections–See Monitor Test Setup**

2. **MODE switch**
   Set according to network.

3. **CHANNEL FORMAT switch**
   Set to SIGNLING.

4. **AUX switch**
   Press to access auxiliary functions (LED ON).

   Select AUX 24 TRK DEF. Configure as shown.



5. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

6. **SCI switch**
   Set to MONITOR.

7. **SCII switch**
   Set to L1 to monitor calls originating from the IXC.
   Set to L2 to monitor calls originating from the LEC.

8. **LINE 1 & 2 CHANNEL switches**
   Set to channel (1 to 24) under test.

9. **RESULTS switches**
   Select the CHANNEL category. Scroll to result 2101 DUR.

10. **RESTART switch**
    Press to begin the test and clear results. Verify MONITOR appears in display. Wait to capture call.

11. **Local Status LEDs**
    Verify that the green Signal and Frame Sync LEDs are illuminated.

12. **Volume**

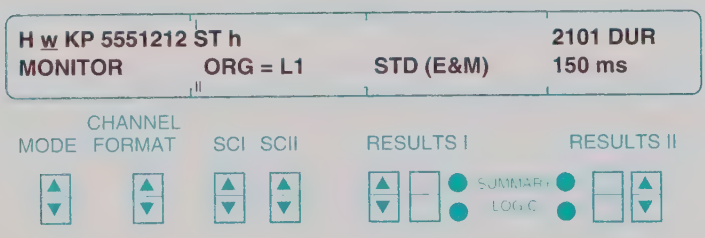
Verify that the call was received correctly and that the continuity of the call by listening to audible faults.

13. **Results verification**

Verify that the call was connected correctly.

SIGNALING KEYPAD LID

Use the **CURSOR** and right and left **ARROW** keys to place the cursor under events or digits. Place the cursor under the **w** to display the delay and duration results of the wink. Place the cursor under a digit to display its delay, duration, level, and frequency. Select specific results in the CHANNEL category.



14. **Results interpretation**

Wink delay and duration — switch wink timing parameters need adjustment.

Incorrect digits being sent — potential switch translation problem.

Incorrect number of digits — potential switch translation problem.

On hook during conversation — potential switch line/trunk card problem.

Incorrect digit frequency or level — potential switch line card problem.

NOTE: To measure delay, duration, level, and frequency on digits requires the Digit Analysis Option.

36. Scan T1 For Active Channels
Signaling Option Required

- Monitor any combination of the 24 channels for channel seizure.
- Monitor call detail on seized channel.

Figure 36 illustrates a T-BERD 224 scanning the T1 for active channels.

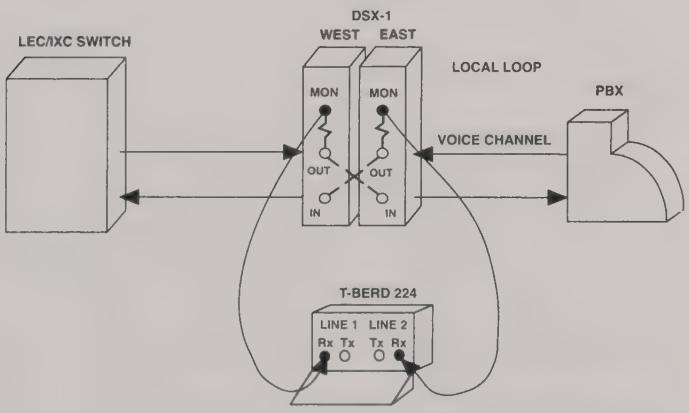


Figure 36
Monitor T1

1. **T1 circuit connections — See *Monitor Test Setup***

2. **MODE switch**
   Set according to network.

3. **CHANNEL FORMAT switch**
   Set to SIGNLNG.

4. **AUX switch**
   Press to access auxiliary functions (LED ON).
   Select AUX 24 TRK DEF. Configure as shown.

AUX 24	TRUNK TYPE
TRK DEF	STD(E&M)

   Select AUX 29 SCANSET. Configure as shown to scan all 24 channels.

AUX 29	*CHAN 1^/0v	FWD^/REVv	
SCANSET	111111	111111	111111 111111

5. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

6. **SCI switch**
   Set to SCAN.

7. **SCII switch**
   Set to L1 to monitor calls originating from the IXC/LEC.
   Set to L2 to monitor calls originating from the PBX.
   Set to AUTO to monitor calls from either direction.

8. **LINE 1 & 2 CHANNEL displays**
   When channel is seized the channel number will display.

9. **RESULTS switches**
   Select the CHANNEL category. Scroll to result n100 DUR.

10. **RESTART switch**
    Press to begin the test and clear results.

11. Local Status LEDs

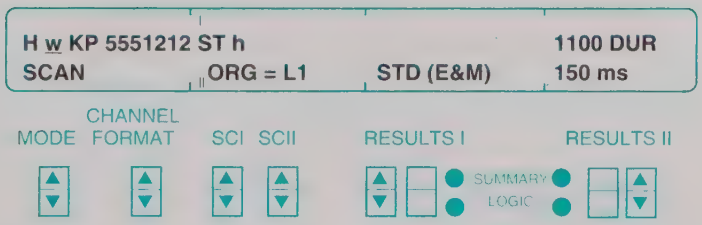
Verify the green Signal and Frame Sync LEDs are illuminated.

12. Results verification

Verify that the call was connected correctly. The seized channel's supervisory events and digits are displayed.

SIGNALING KEYPAD LID

Use the right and left **ARROW** keys to place the cursor under events or digits. Place the cursor under the **w** to display the delay and duration of the wink. Place the cursor under a digit to display its delay, duration, level, and frequency.



13. Results interpretation

Wink delay and duration — switch wink timing parameters need adjustment.

Incorrect digits being sent — potential switch translation problem.

Incorrect number of digits — potential switch translation problem.

On hook during conversation — potential switch line/trunk card problem.

Incorrect digit frequency or level — potential switch line card problem.

NOTE: To measure delay, duration, level, and frequency on digits requires the Digit Analysis Option.

14. RESTART switch

Press to scan channels for activity.

NOTE: When both lines go ON HOOK or after a user selected timeout, the T-BERD 224 resumes scanning the T1 for channel seizure. To resume the SCAN before the user selected timeout is up press the **RESTART** switch.

37. Switch 56 Testing
Signaling and BERT Options Required

- Emulate customer premise equipment.
- Test ability of switch to receive a data call.
- Test the ability to establish a data line through a public switching network.

Figure 37 illustrates a T-BERD 224 testing a Switch 56 system.

1. **T1 circuit connections — See *Termination Test Setup - Recovered Timing***

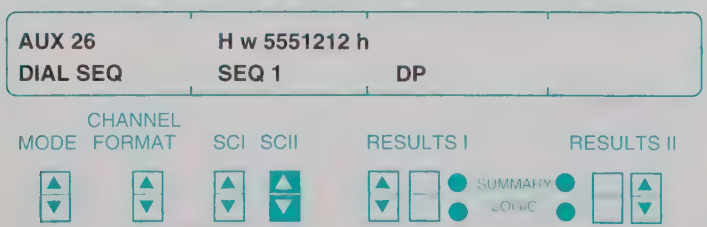
2. **MODE switch**
   Set according to network.

3. **CHANNEL FORMAT switch**
   Set to SWI-56.

4. **SCI switch**
   Set to DIAL SEQ.

5. **SCII switch**
   Set SEQ 1.

6. **AUX switch**
   Press to access auxiliary functions (LED ON).
   Select AUX 26 DIAL SEQ. Configure as shown.



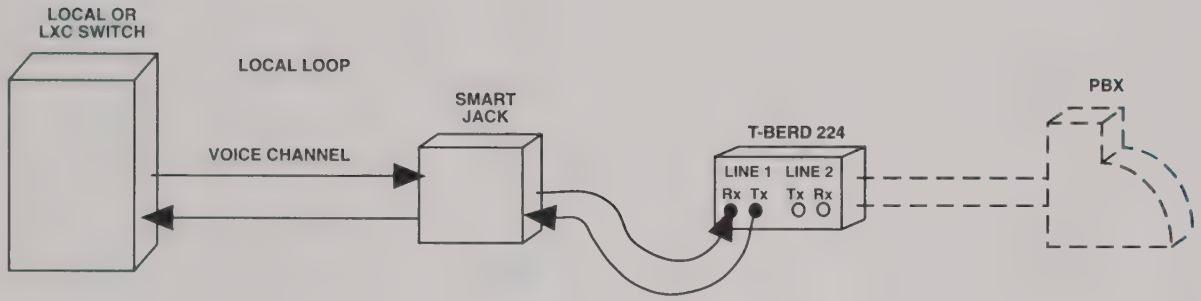
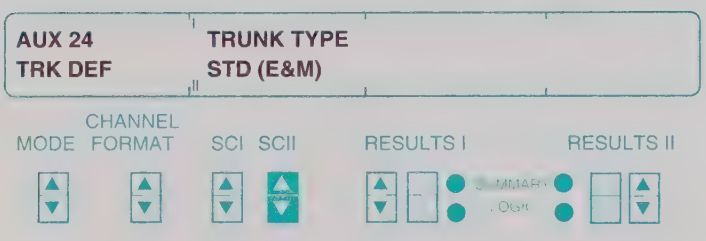
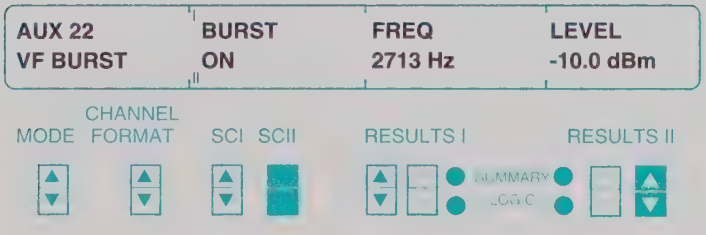


Figure 37
Switch 56 Testing

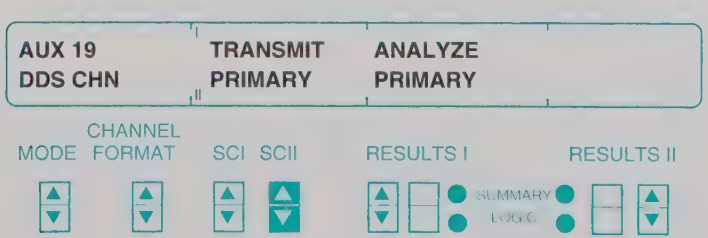
Select AUX 24 TRK DEF. Configure as shown.



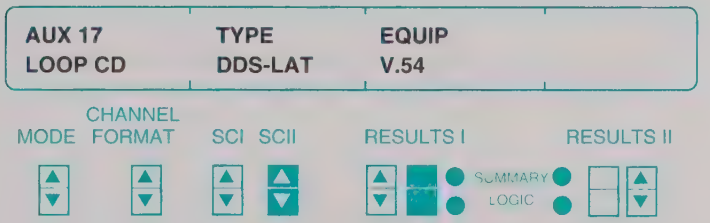
Select AUX 22 VF BURST. Set to ON if echo cancelers are present.



Select AUX 19 DDS CHN. Configure as shown.



Select AUX 17 LOOP CD. Configure as shown to loop the CSU without dropping the call.



SIGNALING KEYPAD LID

ORIG SUPV — Press OFF HOOK.
TERM SUPV — Press wink.
KEYPAD — Enter number to be dialed (typically dial pulse).
ENTER — Press to store sequence.

7. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

8. **LINE 1 & 2 CHANNEL switches**
   Set to the channel under test.

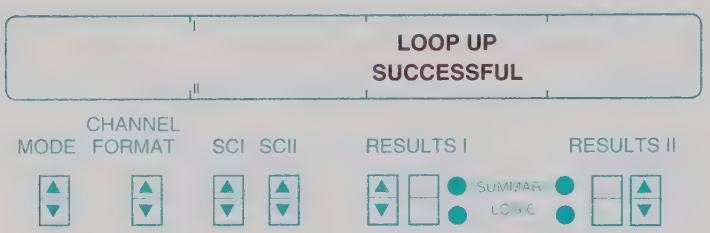
9. **DROP switch**
   Set to LINE 1.

10. **INSERT switch**
    Set to LINE 1.

11. **RESTART switch**
    Press to restart test and clear all results and dial the call.

12. **SCI switch**
    Set to a BERT pattern.

13. **LOOP UP switch**
    Press to send the loop-up code. The switch LED illuminates until loop code is detected. When the loopback is established, the test restarts.

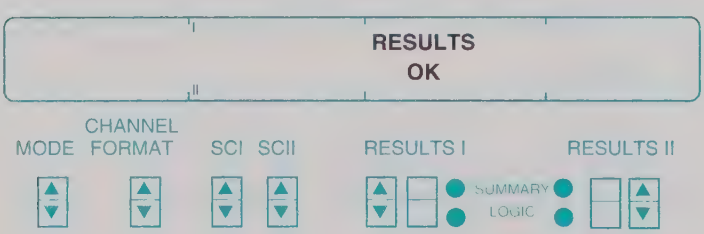


14. **Local Status LEDs**

    Verify that the green Signal, Pattern Sync, and Frame Sync LEDs are illuminated.

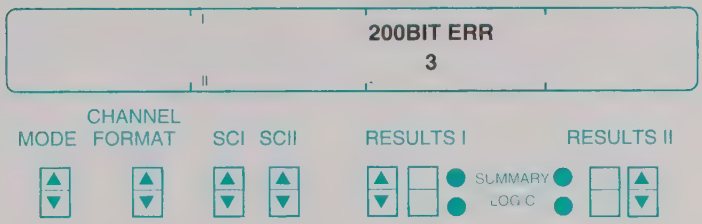
15. **RESULTS I switches**

    Select the SUMMARY category. Verify results are *OK*.



16. **LOGIC ERROR INSERT switch**

    Verify the loop by pressing this switch three times. Three bit errors should register in the n00-BIT ERR result.



17. Local Status LEDs

Verify that the green Signal and Frame Sync and Pattern Sync LEDs are illuminated.

18. Results interpretation

FRM ERRORS, CRC ERRORS, BPVs

Local T1 span problem. Possible faulty repeater, span line noise, cross talk, poor cabling, or defective DSX jacks. Electrical noise generated near the metallic span can also contribute to errors received at the test set.

BPVs and BIT ERRORS

Check the last repeatered span before your present location. BPVs are present only on metallic loops and are removed before the data is retransmitted by practically every piece of transmission equipment except repeaters.

BIT ERRORS only

Check the local loop or one of the channel cards in the network. Sectionalize the network by establishing loopbacks at different locations. Ex: OCU, DDS-Data Port.

FRM ERRORS, CRC ERRORS, No BPVs

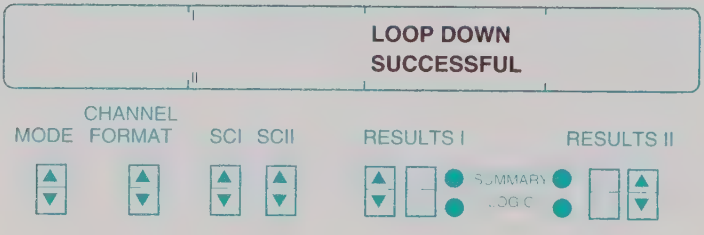
Typically a far-end span line problem. BPVs are corrected by most transmission equipment. Sectionalize the facility further.

Loopback is not established

The CSU is not operating correctly or the line from you to the CSU is bad.

19. LOOP DOWN switch

When the test is completed, send a loop-down code to release loopback. Disconnect the T-BERD 224 from span.



20. Disconnect call

SIGNALING KEYPAD LID

ORIG SUPV — Press ON HOOK.

LEVEL 2 PROTOCOL TESTING

Monitoring SS7/ISDN Protocol

4. **SCI switch**
   Set to SS7 MON or ISDNMON.

5. **LINE 1 & 2 CHANNEL switches**
   Set to channel (1 to 24) under test.

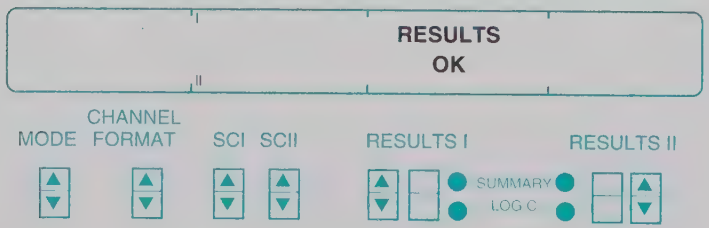
6. **DROP switch**
   Set to BOTH.

7. **INSERT switch**
   Set to NONE.

8. **RESTART switch**
   Press to begin the test and clear results.

9. **Local Status LEDs**
   Verify that the green Signal and Frame Sync (if applicable) LEDs are illuminated.

10. **RESULTS I switches**
    Select the SUMMARY Category. Verify results are OK.

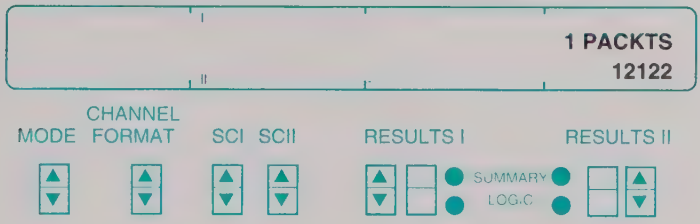


The following messages may appear in the SUMMARY category when monitoring SS7 protocol. Refer to Test Results, SUMMARY Category, for message definitions.

Ln BUSY STATUS	Busy Status Alarm
Ln EMRGNCY ALIGN STAT	Emergency Alignment Status Alarm
Ln NORMAL ALIGN STAT	Normal Alignment Status Alarm
Ln OUT OF ALIGNMENT	Out of Alignment Alarm
Ln OUT OF SERVICE	Out of Service Alarm
Ln PROCESR OUTAGE	Processor Outage Alarm

10. RESULTS II switches

Select the CHANNEL Category. Check the following results.



11. Results Interpretation

Refer to Application 6, T1 Performance Monitoring to determine the status of the T1 signal.

The following SS7 test results provide information on key components of an SS7 facility.

n PACKTS — Packets
n MSUs — Message Signal Units
n FISUs — Fill-In Signal Units
n LSSUs — Link Status Signal Units
n %UTIL — MSU to total packet relationship
n ER PKCRC — CRC Errored Packets
n ER MSU — Errored Message Signal Units
n PKT ES — Packet CRC Errored Seconds
n PKT ERT — Packet CRC Error Rate
n NACKs — Negative Acknowledgments
n DISC PKTs — Discarded Packets

The following ISDN test results provide information on key components of an ISDN facility.

n PACKTS — Packets
n ER PKCRC — CRC Errored Packets
n PKT ES — Packet CRC Errored Seconds
n DISC PKTs — Discarded Packets
n PKT ERT — Packet CRC Error Rate

TEST RESULTS

Results are numbered using an nXX format where n = the line number (1 for LINE 1 and 2 for LINE 2) and XX = the result number.

SUMMARY Category

n00BIT ERR

Bit Errors — A count of received bits that have a value opposite that of the corresponding transmitted bits (Mark or Space) after pattern synchronization is achieved.

n09PAT SLP

Pattern Slips — A count of the total number of pattern slips detected since the beginning of the test. The result is only valid when using pseudorandom test patterns. A pattern slip is a difference (one or more bits are missing or added) between the transmitted and received test pattern.

n17F FR ES

Far-End Frame Error Seconds — A count of the seconds in which one or more frame errors occurred in the far end received signal. This result reports on the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

n18F F SES

Far-End Severely Errored Framing Seconds — A count of the seconds in which two or more frame errors occurred in less than 3 ms in the far end received signal. This result reports on the PRM Severely-Errored Framing Event Bit (SE = 1) status.

n19F BPV S

Far-End BPV Seconds — A count of the seconds in which one or more BPVs occurred in the far end received signal. This result reports on the PRM Line-Code Violation Event Bit (LV = 1) status.

n20F SLP S

Far-End Controlled Slip Seconds — A count of the seconds in which controlled slips occurred in the far end received signal. This result reports on the PRM Controlled-Slip Event Bit (SL = 1) status.

n22F CRC E

Far-End CRC Errored Events — A count of the minimum number of CRC errors reported in the following n F SI CRC to n F SV CRC results. This result reports on the accumulated PRM CRC Error Event Bit (G1 to G6) results. A ">" (greater than) preceding the count indicates that the Bins 2 through 6 are non-zero.

n25 BPVS

Bipolar Violations — A count of BPVs since the start of elapsed time (excluding intentional violations found within B8ZS codes).

n30FRM ERR

Frame Errors — A count of frame errors detected since initial frame sync. For D1D, D2, and D4 (Superframe) frame errors are counted if either an F_t or F_s frame bit is errored. For SLC-96 framing, frame errors are counted if F_t bits are errored. For ESF and ESFz framing, frame errors are counted only if an error is found on the frame bits. Frame errors are not detected on CRC or datalink bits.

n32CRC ERR

CRC Errors — A count of CRC errors detected since initial frame sync. CRC errors are counted only when ESF or ESFz (optional) framing is detected in the received T1 data.

n34FRM LOS

Frame Losses — A count of discrete losses of frame synchronization since initial frame synchronization.

n40RX FREQ

Receive Frequency — The frequency of the clock recovered from the received data.

n51TM SLIP

Timing Slips — The frequency deviation of uncontrolled clock slips between two input signals measured in positive or negative shifts in bit and frame positions.

n96DDS F E

DDS Frame Errors — A count of the DS0B frame errors detected since the start of the test. Subrate DS0B frame synchronization must be present to display the result.

Messages

POWER LOSS — This message is displayed at power-up if the power has been turned off or when power to the unit has been interrupted. This message is cleared when a test restart is performed.

RESULTS OK — This message is visible in the Results display if the SUMMARY results have a zero value.

FAILED PATTERN — Indicates the failed test patterns when performing a BRIDGTAP or MULTIPAT test. The failed pattern is also indicated.

NOT B8ZS COMPATIBLE — The received signal is not B8ZS compatible when transmitting B8ZS encoded ALL ZEROS.

Ln 1's DENS VIOLATED — The T1 signal violated the ones density criteria, N/8(N+1) bits where N = 1 to 23 ones.

Ln FE LOOP PROTECTION

SLC Protection Line Far-End Loop Alarm — A state in which the protection line is in loopback.

Ln FE LOOP SHELF (x)

SLC Shelf Far-End Loop Alarm — A shelf state in which the indicated DS1 shelf is in loopback. (x) indicates which shelf (A, B, C or D) is looped.

Ln MAINT HOOK/SEIZE

SLC On-Hook/Seize RC Maintenance Message — This message appears when either the *On-hook* or *Seize RC* message is received.

Ln MAINT PROCEED

SLC Proceed CR/RC Maintenance Message — Receiving the message from the COT, the COT is asking to proceed. Receiving the message from the RT, the RT is ready to continue.

Ln MAINT TEST ALRM

SLC Test Alarm CR/RC Maintenance Message — Either the COT or the RT has failed the bypass procedure.

Ln SLC ALM (x) ON PROT

SLC Shelf on Protection Line Alarm — A shelf DS1 is switched over to the protection line. (x) indicates which shelf (A, B, C or D) is switched to the protection line.

Ln SLC ALM MAJOR

SLC Major Alarm — A system state characterized by a loss of service to subscribers served by a shelf or shelf group exists. If a shelf alarm (Ln SLC ALM SHELF (x)) is also reported, this result is not displayed.

Ln SLC ALM MINOR

SLC Minor Alarm — A system state characterized by a non-service affecting fault exists. If a far-end loop alarm message is reported for the same line (L1 or L2), this message is not displayed.

Ln SLC ALM POWER/MISC

SLC Power/Miscellaneous Alarm — An RT state in which losing power or miscellaneous conditions have occurred.

Ln SLC ALM SHELF (x)

SLC Shelf Alarm — A system state characterized by a shelf's loss of operational integrity. (x) indicates the shelf (A, B, C or D) generating the shelf alarm.

SW PROT FAILED

Switch to Protection Line Failed — During either a far-end loopback or a switch to protection line sequence the switch to protection line operation failed.

Ln BUSY STATUS

Busy Status Alarm — Receiving end of the signaling link has detected traffic congestion. This message is transmitted to the transmitting end to distinguish between congestion and failures in the signaling link.

Ln EMRGNCY ALIGN STAT

Emergency Alignment Status Alarm — Signaling link is being realigned with the emergency alignment procedure. The message is transmitted when, after having started an initial alignment, the out

of alignment, normal alignment, or emergency alignment status indication is received and the terminal is in the emergency alignment procedure.

Ln NORMAL ALIGN STAT

Normal Alignment Status Alarm — Signaling link is being realigned with the normal alignment procedure. The message is transmitted when, after having started an initial alignment, the out of alignment, normal alignment, or emergency alignment status indication is received and the terminal is in the normal alignment procedure.

Ln OUT OF ALIGNMENT

Out of Alignment Alarm — Signaling link is not aligned. The message is transmitted when the initial alignment has been started, and the out of alignment, normal alignment, or emergency alignment status indication has not been received from the signaling link.

Ln OUT OF SERVICE

Out of Service Alarm — Signaling link terminal is out of service. The message is transmitted when the terminal cannot transmit or receive MSUs. This message does not apply during a processor outage.

Ln PROCESR OUTAGE

Processor Outage Alarm — Local processor outage or failure has occurred. This message is transmitted by level 2 when the signaling messages cannot be transferred to functional levels 3 and/or 4.

LOGIC Category

n00BIT ERR

Bit Errors — A count of received bits that have a value opposite that of the corresponding transmitted bits (Mark or Space) after pattern synchronization is achieved.

n01ASYN ES

Asynchronous Errored Seconds — A count of test seconds where one or more bit errors occurred.

n04 BER

Bit Error Rate — The ratio of bit errors to received pattern data bits.

n05 EFS

Error-Free Seconds — A count of the seconds during which pattern synchronization was maintained through the entire second and no bit error occurred.

n06 % EFS

Percent Error-Free Seconds — The ratio, expressed as a percentage, of error-free seconds to the total number of seconds during which pattern synchronization is present.

n07 SYN ES

Synchronous Errored Seconds — A count of errored seconds synchronized to the occurrence of an error (the count and time intervals begin with the occurrence of an error).

n08OOS SEC

Out-of-Synchronization Seconds — A count of the total number of seconds since the beginning of the test during which pattern synchronization was not maintained for the entire second.

n09PAT SLP

Pattern Slips — A count of the total number of pattern slips detected since the beginning of the test. The result is only valid when using pseudorandom test patterns. A pattern slip is a difference (one or more bits are missing or added) between the transmitted and received test pattern.

n10 SES

Severely Errored Seconds — A count of seconds during which the bit error ratio was greater than 10^{-3} within available time.

n11 % SES

Percent Severely Errored Seconds — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.

n12 DEG MN

Degraded Minutes — A count of minutes during which the bit error ratio was greater than 10^{-6}.

n13 %DEGMN

Percent Degraded Minutes — The ratio, expressed as a percentage, of degraded minutes to the number of available minutes.

n14 UNAV S

Unavailable Seconds — A count of unavailable time per CCITT G.821.

n15 %AVLBL

Percent Availability — The ratio, expressed as a percentage, of available seconds to the number of test seconds.

n16 CSES

Consecutive Severely Errored Seconds — A count of the number of groups of three or more contiguous seconds in which an error rate greater than 10^{-3} was found in each second.

BPV & FRAME Category

n17F FR ES

Far-End Frame Error Seconds — A count of the seconds in which one or more frame errors occurred in the far end received signal. This result reports on the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

n18F F SES

Far-End Severely Errored Framing Seconds — A count of the seconds in which two or more frame errors occurred in less than 3 ms in the far end received signal. This result reports on the PRM Severely-Errored Framing Event Bit (SE = 1) status.

n19F BPV S

Far-End BPV Seconds — A count of the seconds in which one or more BPVs occurred in the far end received signal. This result reports on the PRM Line-Code Violation Event Bit (LV = 1) status.

n20F SLP S

Far-End Controlled Slip Seconds — A count of the seconds in which controlled slips occurred in the far end received signal. This result reports on the PRM Controlled-Slip Event Bit (SL = 1) status. In addition, the T-BERD 224 transmits the PRM with the Controlled-Slip Event Bit (SL) set to 0.

n21PRM TIM

Received Performance Report Time — A count of the total number of seconds, since test restart, in which a valid PRM was received.

n22F CRC E

Far-End CRC Errored Events — A count of the minimum number of CRC errors reported in the following n F SI CRC to n F SV CRC results. This result reports on the accumulated PRM CRC Error Event Bit (G1 to G6) results. A > (greater than) preceding the count indicates that the bits two through six are non-zero.

n F SI CRC

Far-End Single CRC Errored Seconds — A count of the seconds with only one CRC error reported in the far end received signal. This result reports on the first PRM CRC Error Event Bit (G1 = 1).

n F LO CRC

Far-End Low CRC Errored Seconds — A count of the seconds with two to five CRC errors reported in the far end received signal. This result reports on the second PRM CRC Error Event Bit (G2 = 1).

n F MD CRC

Far-End Medium CRC Errored Seconds — A count of the seconds with six to 10 CRC errors reported in the far end received signal. This result reports on the third PRM CRC Error Event Bit (G3 = 1).

n F MH CRC

Far-End Medium High CRC Errored Seconds — A count of the seconds with 10 to 100 CRC errors reported in the far end received signal. This result reports on the fourth PRM CRC Error Event Bit (G4 = 1).

n F HI CRC

Far-End High CRC Errored Seconds — A count of the seconds with 101 to 319 CRC errors reported in the far end received signal. This result reports on the fifth PRM CRC Error Event Bit (G5 = 1).

n F SV CRC

Far-End Severe CRC Errored Seconds — A count of the seconds with 320 to 333 CRC errors reported in the far end received signal. This result reports on the sixth PRM CRC Error Event Bit (G6 = 1).

n23PAY SRC

Far-End Payload Source/Loopback — Identifies the direction of the PRM according to the PRM Command/Response Bit (C/R) and the Payload Loopback Activated Bit (LB). In end-to-end applications, a customer generated PRM is indicated as CUST (C/R = 0 and LB = 0) and a carrier generated PRM is indicated as CARR (C/R = 1 and LB = 0) in the display. In payload loopback applications, the customer generated PRM is indicated as CUST LOOP (C/R = 0 and LB = 1) when the customer is looped back and the carrier generated PRM is indicated as CARR LOOP (C/R = 1 and LB = 1) when the carrier is looped back.

n25 BPVS

Bipolar Violations — A count of BPVs since the start of elapsed time (excluding intentional violations found within B8ZS codes).

n26BPV SEC

Bipolar Violation Seconds — The number of seconds within which one or more BPVs occurred since the start of elapsed time.

n27 BPV RT

Bipolar Violation Rate — The ratio of BPVs to the number of data bits received.

n28 FRM ES

Frame Errored Seconds — A count of seconds during which one or more frame errors occurred.

n29FRM SES

Frame Severely Errored Seconds — A count of seconds during which the total number of frame errors equaled 12 or more (D4 framing only).

n30FRM ERR

Frame Errors— A count of frame errors detected since initial frame sync. For D1D, D2, and D4 (Superframe) frame errors are counted if either an F_t or F_s frame bit is errored. For SLC-96 framing, frame errors are counted if F_t bits are errored. For ESF and ESFz framing, frame errors are counted only if an error is found on the frame bits. Frame errors are not detected on CRC or datalink bits.

n31FRM ERT

Frame Error Rate — The ratio of frame errors to the number of analyzed framing bits. For D1D, D2, and D4 framing, the Frame Error Rate is the ratio of frame errors to the number of F_t and F_s bits, and for SLC-96 it is the ratio of frame errors to the number of F_t bits.

For ESF and ESFz framing the Frame Error Rate is the ratio of frame errors to the frame bits analyzed.

n32CRC ERR

CRC Errors — A count of CRC errors detected since initial frame sync. CRC errors are counted only when ESF or ESFz framing is detected in the received T1 data.

n33 CRC ES

CRC Errored Seconds — A count of seconds within which one or more CRC errors are detected.

n34FRM LOS

Frame Losses — A count of discrete losses of frame synchronization since initial frame synchronization.

n35FR LS S

Frame Loss Seconds — A count of seconds within which frame synchronization was lost or could not be achieved since initial frame synchronization. This includes seconds when a signal loss causes a frame synchronization loss.

n36CRC SES

CRC Severely Errored Seconds — A count of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.

n37CRC ERT

CRC Error Rate — The ratio of CRC errors to the number of extended superframes received.

SIGNAL Category

n40RX FREQ

Receive Frequency — The frequency of the clock recovered from the received data.

n41 RX LVL

Receive Level (in dBdsx) — The level of the received signal in dB, relative to a standard 3-volt base-to-peak signal (DSX level).

n42 RX LVL

Receive Level (in dBm) — The power level of an unframed all-ones signal (available only when AIS is detected).

n43 RX LVL

Receive Level (in V p-p) — The level of the received signal in peak-to-peak volts. The signal level is displayed as volts (V) when the signal level is greater than 1 volt or as millivolts (mV) when the signal level is less than 1 volt.

n50SPX CUR

Simplex Current — The magnitude of the simplex current flowing between the LINE 1 receiver and LINE 2 transmitter, or LINE 2 receiver and LINE 1 transmitter. The line number is determined by the DROP switch setting. The result measurement range is 0 mA to 250 mA with an accuracy of ±2 mA.

n51TM SLIP

Timing Slips — The frequency deviation of uncontrolled clock slips between two input signals measured in positive or negative shifts in bit and frame positions.

n52SLP SEC

Slip Analysis Seconds — A count of test seconds during which Timing Slip Analysis occurred.

n53 DELAY

Round Trip Delay — The time it takes a pseudorandom test pattern to be transmitted and received in a loopback test. The result can measure round trip delay from 0.324 ms to 10 seconds.

55 TRAFFIC

Traffic Results — A display of the A and B signaling bits for all 24 channels of LINE 1 and LINE 2. Scrolling to this result causes the entire VF display (both lines) to show the signaling bit states for each line's 24 channels in 4 fields, with 6 channels at a time (1-6, 7-12, 13-18, and 19-24).

n56 TRAFFIC

Traffic Results (For ESF and ZBTSI framed signals) — A display of the A, B, C, and D signaling bits for all 24 channels of LINE 1 or LINE 2. Scrolling to this result causes the entire VF display (both lines) to show the signaling bit states for each line's 24 channels in 4 fields, with 6 channels at a time (1-6, 7-12, 13-18, and 19-24).

NOTE: The TRAFFIC result uses the entire display window. In order to return to the normal display, the corresponding **RESULTS Category** or **Results** switch must be pressed to exit the TRAFFIC display.

TIME Category

n70SG LS S

Signal Loss Seconds — A count of test seconds during which the signal was not present or during which one or more signal losses occurred.

n71ALM SEC

Alarmed Seconds — A count of test seconds during which a yellow alarm, unframed all ones (AIS), or excess zeros alarm is detected. Continues to count through signal loss after detecting the alarm conditions.

72TST LEN

Test Length — The currently set test length for a timed test, in HHH:MM:SS format. The test length is set using AUX 03 TES LEN function.

n73ELAP TM

Elapsed Time — The number of hours, minutes and seconds after a signal of proper frequency and level has been detected since a test restart. Elapsed time continues to increment during signal losses.

74TST END

Test Ends — Displays the time remaining for a timed test in progress using the HH:MM:SS format. "****" is displayed when the test set is in CONTINUOUS test mode.

75 TIME

Clock Time — Displays time of day using a 24 hour (military) clock, using the HH:MM:SS format.

76 DATE

Calendar Date — Displays the date in the MMM DD format.

n79SLC A S

SLC Alarm Seconds — The number of seconds during which a SLC-96 Datalink Alarm occurred.

CHANNEL Category

n80RCV BYT

DDS Received Byte — Displays the received 8-bit byte of the selected channel. If the received byte is recognized as a control code, the control code name is displayed in the n95 RCODE result.

n81VF FREQ

Voice Frequency — The frequency (Hz) of a VF tone within a selected dropped channel when the DROP switch is set to LINE 1 or LINE 2.

n82 VF LVL

VF Level — The level (dBm) of a VF tone within a selected DS0 channel referenced to a digital milliwatt.

n84 3KFLAT

3 kHz Flat Noise — A measure of the noise (dBrn) weighted with a 3 kHz flat filter. Used when qualifying data-grade circuits.

n85 3K NCH

3 kHz Notch Noise — A measure of the noise (dBrn) against a weighted 3 kHz flat filter with a transmitted 1004 Hz tone that is filtered out prior to the measurement for analog data-grade analysis. This measurement includes quantization noise caused by analog/digital conversion in the CODEC.

n86 C-MSG

C-Message Noise — A measure of the noise (in dBrnC) weighted with a C-message distribution for voice-grade analysis. This measurement determines the idle channel noise on a circuit.

n87 C-NCH

C-Message Notch Noise — A measure of the noise (in dBrnC) against a weighted C-message filter with a transmitted 1004 Hz tone that is filtered out prior to the measurement for voice-grade analysis.

n88 S/N

Signal-to-Noise Ratio — The ratio (in dB) of received signal level to noise level. The noise level is weighted with a C-message filter with a transmitted 1004 Hz tone that is filtered out prior to the measurement.

n89 DC-OFF

DC-Offset — The average DC voltage level (in mV) of the received analog signal with respect to time. VF signals should have DC offsets of approximately zero millivolts (0 mV).

n90 P/AR

Peak to Average Ratio — The ratio (in P/AR units) of transmitted peak signal level of 16 non-harmonically related frequencies to the average received level of the signal. This measurement is only available when PAR is selected as the test.

n91 PAR LV

Peak to Average Ratio Level — The RMS level (in dBm) of the received signal. This measurement is only available when PAR is selected as the test.

n92 ERL

Echo Return Loss — The ratio (in dB) of the power transmitted by the T-BERD 224 to the power reflected by the terminated circuit [ERL = 10 log (TX power/RX power)].

n93 SRL-HI

Singing Return Loss - High — The ratio (in dB) of the noise power transmitted for a shaped high frequency band to the power reflected by the terminated circuit.

n94 SRL-LO

Singing Return Loss - Low — The ratio (in dB) of the noise power transmitted for a shaped low frequency band to the power reflected by the terminated circuit.

n95 RCODE

Reportable DS0 Control Code — Displays the name of the received DS0 code identified in the n80 RCV BYT result.

n96DDS F E

DDS Frame Errors — A count of the DS0B frame errors detected since the start of the test. Subrate DS0B frame synchronization must be present to display the result.

n98%IN SRV

Percent of In-Service Bits — The percentage of time in which the DDS control bit (bit 8) is a 1. The control bit state is determined by a majority vote of three bits and excludes transitions caused by secondary channel activity.

n100 DELAY

Delay — The period of time from an originating event or digit to the indicated terminating event.

n101 DUR

Duration — The length of time during which the indicated event occurred.

n102 ADDR

Address — The type of digit: DTMF, MF, or Dial Pulse.

n104FQ/LVL

Lower DTMF/MF Tone Frequency and Level — The lower DTMF/MF tone frequency in Hertz and signal level in dBm. Table 1 and 2 list the DTMF and MF tone frequencies respectively.

n105FQ/LVL

Upper DTMF/MF Tone Frequency and Level — The upper DTMF/MF tone frequency in Hertz and signal level in dBm. Table 1 and 2 list the DTMF and MF tone frequencies respectively.

n110 ALRM

Alarm Field Format — Identifies the received SLC datalink alarm field format as either 13 bit or 16 bit.

n PACKTS

Packets — The total number of packets (or signal units) detected since test restart. Only packets with unerrored CRCs are counted. Packets include Message Signal Units (MSUs), Link Status Signal Units (LSSUs), and Fill-In Signal Units (FISUs) that are transmitted across the SS7 signaling channel. This result is available when SS7 MON or ISDNMON is selected.

n MSUs

Message Signal Units — The total number of error free MSU packets since test restart. The MSU include useful information on the signaling and the packet routing. This result is available when SS7 MON is selected.

Table 1
Dual-Tone Multifrequency Codes (DTMF)

Low Frequency Tones (Hz)	High Frequency Tones (Hz)			
	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Table 2
Multifrequency Codes (MF)

Frequencies (Hz) High	Low	Multifrequency Signals: Digit and Control	Expanded Inband	TSPS Equal Access	CCITT System 5
900	700	1			1
1100	700	2	Coin Collect		2
1100	900	3			3
1300	700	4			4
1300	900	5			5
1300	1100	6			6
1500	700	7			7
1500	900	8	Operator Released		8
1500	1100	9			9
1500	1300	0	Operator Attached		0
1700	700		Ring Back	ST3P (ST''')	Code 11
1700	900			STP (ST')	Code 12
1700	1100	KP	Coin Return		KP1
1700	1300			ST2P (ST'')	KP2
1700	1500	ST	Coin Collect Operator Released	ST	ST

n FISUs

Fill-In Signal Units — The total number of error free FISU packets since test restart. FISUs provide error monitoring over the signaling channel when no message traffic is being transmitted. This result is available when SS7 MON is selected.

n LSSUs

Link Status Signal Units — The total number of error free LSSU packets since test restart. LSSUs provide flow control over the signaling channel. This result is available when SS7 MON is selected.

n ER PKCRC

CRC Errored Packets — The total number of packets with CRC errors since test restart. This result is available when SS7 MON or ISDNMON is selected.

n PKT ES

Packet CRC Errored Seconds — The total number of seconds with at least one packet with CRC errors since test restart. This result is available when SS7 MON or ISDNMON is selected.

n DISC PKTs

Discarded Packets — The total number of discarded packets since test restart. Discarded packets include packets with bad CRCs, seven successive ones, terminating flag out of alignment, packet too long, or packet too short. This result is available when SS7 MON or ISDNMON is selected.

n PKT ERT

Packet CRC Error Rate — The total number of packet errors (PKT ERS) divided by the total number of packets (PACKTS) plus the total number of discarded packets (DIS PKTs) since test restart. This result is available when SS7 MON or ISDNMON is selected.

n NACKs

Negative Acknowledgments — The total number of Backward Indicator Bit (BIB) field state transitions since test restart. Only packets that have unerrored CRCs are used for this calculation. This result is available when SS7 MON is selected.

n ER MSU

Errored Message Signal Units — The total number of MSU packets with CRC errors since test restart. In order to classify a packet as an MSU, the Length Indicator (LI) field must match with the packet size. For packets that are longer than 63 bytes, the expected LI field value would be equal to 63. This result is available when SS7 MON is selected.

n %UTIL

% of MSU Utilization — The total number of good MSUs (MSUs) divided by the total number of packets (PACKTS) plus discarded packets (DIS PKTs) since test restart. This result is available when SS7 MON or ISDNMON is selected.

ALARMS

Excess Zeros

The red status LED illuminates when 16 or more consecutive zeros are detected. The LED for the corresponding line (LINE 1 or LINE 2) illuminates to indicate on which line the excess zeros are detected.

Yellow Alarm

The red status LED illuminates when a yellow alarm is detected in the received T1 signal. The LED for the corresponding line (LINE 1 or LINE 2) illuminates to indicate on which line the yellow alarm is detected.

AIS

The red status LED illuminates upon detection of an AIS signal (2048 consecutive unframed ones). The LED for the corresponding line (LINE 1 or LINE 2) illuminates to indicate at which input the AIS signal is detected.

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